Global Information Assurance Certification Paper

GCFW Practical
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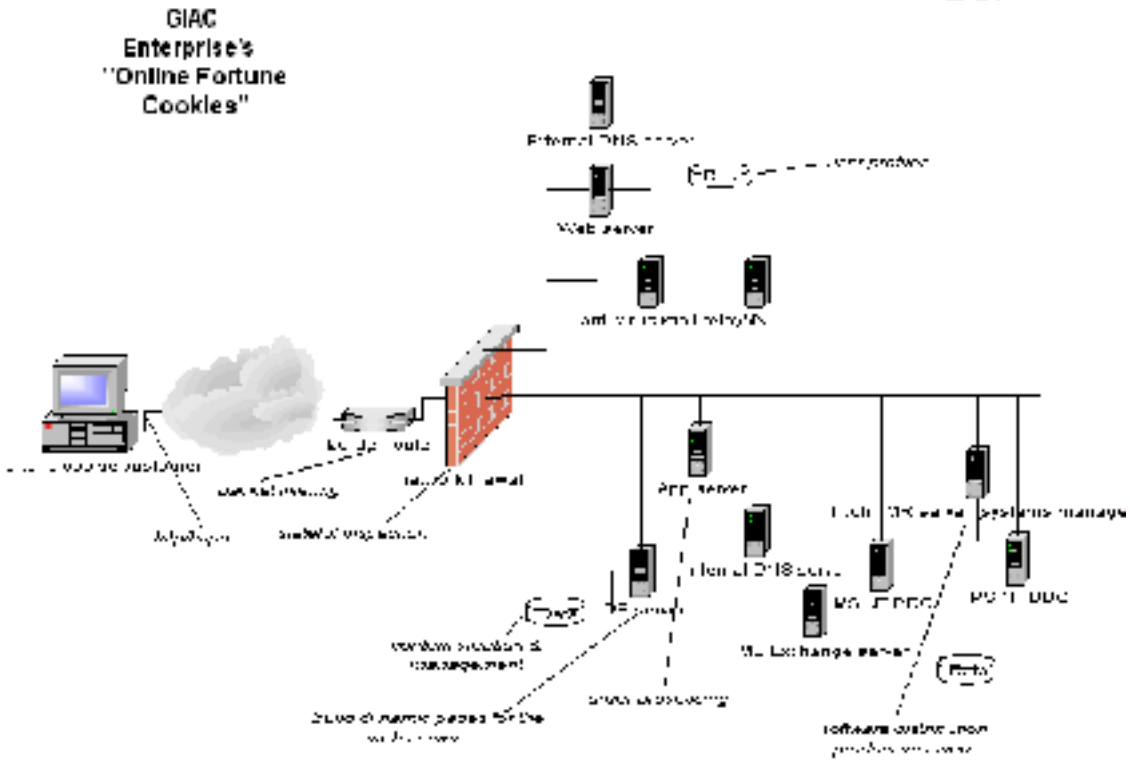
20 November 2000

Assignment 1: Security Architecture

This is a security architecture for GIAC Enterprise's "Online fortune cookie" company:



This architecture will support the implementation of the VISA "Ten Commandments" in the following ways:

1. Install and maintain a working network firewall to protect data accessible via the Internet.
Data traffic from the Internet is first put through a perimeter router, to filter out packets, e.g. those with private IP addresses (1 0.*.*.*, 192.168.*.*, 172.16.*.* -172.31.*.*) which should not be routed across the Internet. The Perimeter Router complements the Network Firewall, by doing some initial filtering, but the default position is to allow traffic through. Equally, the defaul t setting of the Network Firewall will be to deny all traffic.

2. Keep security patches up -to-date.
Tivoli's Software Distribution and Inventory products (http://www.tivoli.com/products/ind ex/software_dist/) will be installed on the Tivoli TMR server. Using these products, one can assess the levels of the software installed, and automatically distribute patches.

3. Encrypt stored data accessible from the Internet.
For sensitive stored da ta, "PGP disk" from Network Associates will be used. Using this product, the sensitive data is encrypted in a logical disk area. To read the encrypted data, the logical disk must be mounted, and a pass phrase must be entered to access the data.

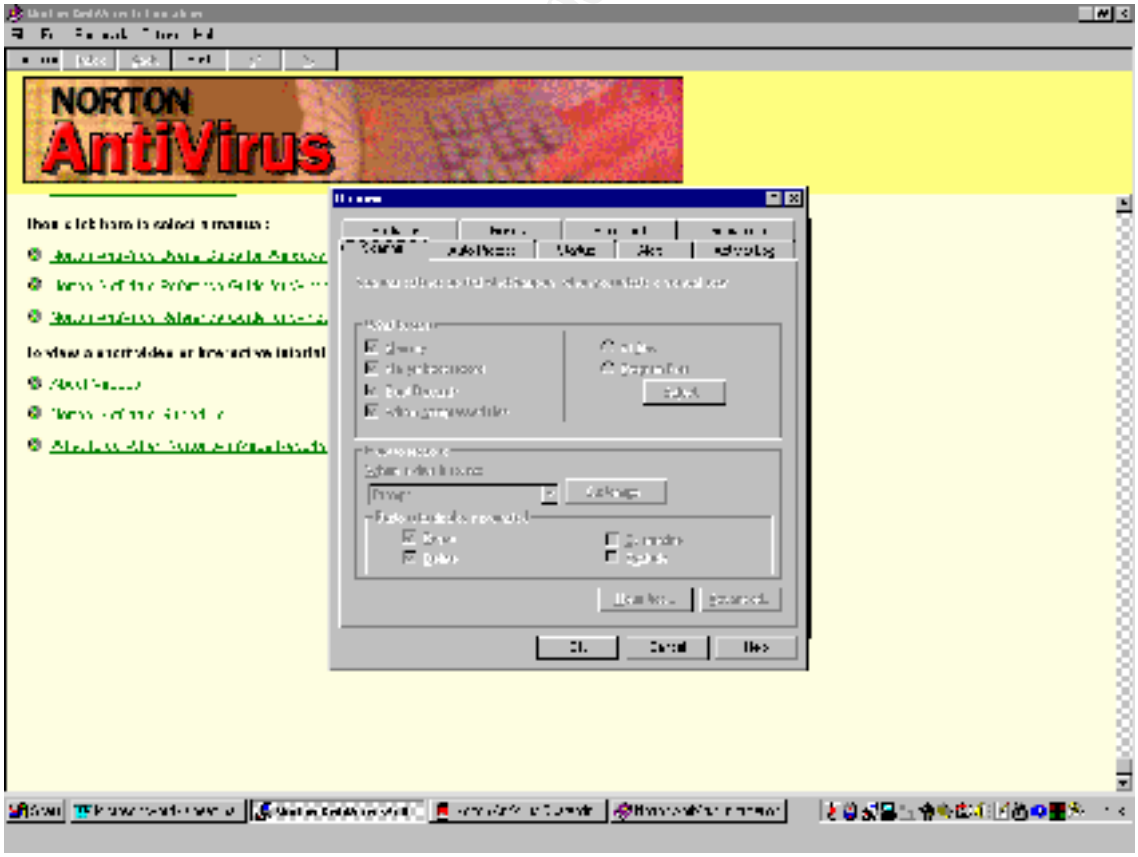
Additionally, the SYSKEY utility (provided by MS Windows NT SP 3) will be used to allow NT passwords to be stored in an encrypted format. SYSKEY adds an extra layer of security to the password data stored in the SAM database by encrypting the hashed password data using a 128-bit system key. Because there is no uninstall option for SYSKEY, the passphrase will be stored in a sealed envelope with a designated person.

For confidential information on the webserver, there are three options:
(1) Restrictions by IP address, subnet, or domain: Individual documents or whole directories are protected in such a way that only browsers connecting from certain IP (Internet) addresses, IP subnets, or domains can access them.
(2) Restriction by username and password: Documents or directories are protected so that the remote user has to provide a name and a password in order to get access
(3) Encryption using public key cryptography: Both the request for the document and the document itself are encrypted in such a way that the text cannot be read by anyone but the intended recipient. Public key cryptography can also be used for reliable user verification.

In the above design for GIAC Enterprise's "Online fortune cookie" company, a username and password will protect confidential information on the webserver.

4. Encrypt data sent across networks.
All hosts on the internal network and on the screened network will use SSH, the secure shell, to communicate with other hosts inside the firewall. Using SSH, all traffic between the hosts will be encrypted (http://www.sans.org/newlook/resources/ssh.htm#16)

5. Use and regularly update anti-virus software.
The company will use Norton Antivirus v.5 (http:\\www.symantec.com). Here is an illustration of the interface:



6. Restrict access to data by business "need to know".
MS Windows NT offers file-level access. Using this facility, different user groups can be created (e.g. administrators, online cookie company employees, others) with varying levels of access to files.

7. Assign unique IDs to each person with computer access to data.
The requirement for unique IDs will be included in the company's security policy, and repeated in the relevant sections of the security procedures manual.

8. Track access to data by unique ID.
NT auditing will be turned on to create logs of what data is accessed by whom and when it was accessed (NT does not provide logging by default). Before you can audit a file's activity, you must turn on the Windows NT auditing feature. To do so, start User Manager from the Administrative Tools program group.

9. Don't use vendor-supplied defaults for system passwords and other security parameters.
MS Windows NT SP 2 provides the passfilt.dll filter for systems administrators who choose not to write filters of their own. Later Service Packs has improved the passfilt.dll.

After making a change to the NT registry to include the passfilt.dll, the following password policy is implemented:

- Passwords may not contain your user name or any part of your full name.
- Passwords must be at least six characters long.
- Passwords must contain elements from three of the four following types of characters:

Character types	Examples
English upper case letters	A, B, C, ... Z
English lower case letters	a, b, c, ... z
Westernized arabic numerals	0, 1, 2, ... 9
Non-alphanumeric characters (special characters)	$,!,%,^

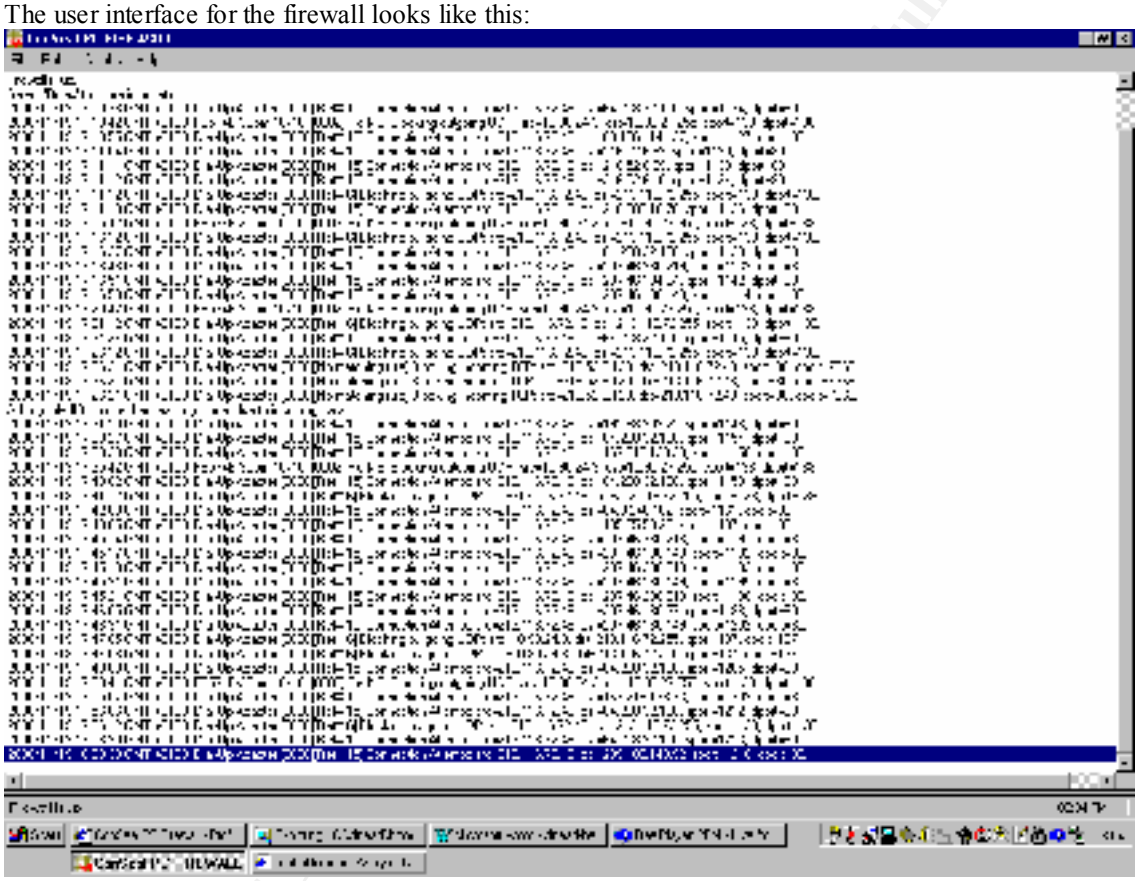
10. Regularly test security systems and processes.
There are five parts to this effort:
(1) Because a good audit needs a good baseline, a written procedure will be developed to use MS-supplied tools daily (from the NT Resource Kit at http://www.microsoft.com/ntserver/nts/downloads/recommended/ntkit/default.asp). By automating the running of some of these tools (using the NT scheduler 'AT' to run a batch job), and e-mailing exceptions to the systems administrator, an understanding of the normal behaviour of the network can be gathered. A popular tool to include in the batch file is NTlast (to extract logon information such as failed and successful logons from an NT server).
(2) The systems administrator will also run public domain analysis tools on the environment (border router, network firewall and the networks protected by the Firewall) weekly. These tools include SATAN and nmap, which scan a host's ports to identify vulnerabilities.
(3) The staff in the IT department will subscribe to a security advisory service, such as CERT (http://www.cert.org/contact_cert/certmaillist.html) or GIAC (http://www.sans.org/giac.htm), to raise awareness within the company of current security threats. Another reason for subscribing to one of these organisations is to have a contact to report suspicious events to. Reporting suspicious activity in logfiles helps the Information Security community, by co-ordinating research efforts to deal with the most common suspicious behaviours.
(4) An external company will be engaged once a year to perform an ethical hack on the environment. This will provide the company's technical staff with up-to-date information about the latest security tools, and will also verify the integrity of the information security efforts.
(5) IT staff will test that security components fail to a known state. For instance, should there be a problem with the Fire wall, all network traffic should be blocked rather than automatically let through.

Assignment 2: Security Policy

This is a tutorial on how to implement filtering at the "Online fortune cookie" company ADDITIONAL to that recommended in the SANS Top 10 d ocument (http:\\www.sans.org/topten.html).

ConSeal PC Firewall v2.06, developed by the Canada -based firm Signal 9, is the perimeter defence being used. In January 2000, McAfee.com announced that it was tak ing over Signal 9. Further information about this Firewall is available from http://www.consealfirewall.com .

The user interface for the firewall looks like this:



Information on blocking instructions for the "top ten" security vulnerabilities may be found from Gerard Fowley's practical at http://www.sans.org/giactc/gcfw.htm . The practical includes blocking instructions for the following traffic:

Border Router

- Anti spoofing protection and logging for ingress and egress.
- Denial and logging of management or direct access attempts to outer and inner firewalls.
- Denial and logging of egress from unexpected IP addresses.

Outer Firewall

- Anti spoofing protection and logging for ingress and egress.
- Denial-of-service protection and logging for eCommerce network.
- Static network address translation (NAT) for eCommerce network servers.
- Denial and logging of unexpected management or direct access attempts to inner f irewall and border router.
- Denial and logging of egress from unexpected IP addresses.

- Restriction of ingress to eCommerce network and logging of exceptions (probably too much traffic to log all normal access).
- Restriction and logging of egress from eCommerce network.
- Restriction and logging of ingress & egress of Service network.
- Restriction and logging of egress from inner firewall's external dynamic NAT addresses (translated source address of internal egress traffic).
- Denial and logging of all other traffic.

In addition to that filtering, I would recommend the following:

Border Router

To control the transmission of packets, and to prevent the Network Firewall from becoming a performance bottleneck, the Border Router can do some packet filtering. As the company is an e-commerce site, response times will be very important, and will justify the improved performance that a Border Router will deliver. When choosing a Border Router, some popular options are Cisco, Bay or using a PC clone running a router emulator such as gated.

A CISCO 1600 Series Router "connects Ethernet LANs to WANs via ISDN, asynchronous serial and synchronous serial connections, supporting Frame Relay, leased lines, Switched 56, Switched Multimegabit Data Service (SMDS), and X.25 ", and is available for less than $1,300 (http://www.networkdeals.com/proddetail.asp?LineNumber=171).

I would recommend ensuring that the anti-spoofing protection includes blocking all inbound packets where the source IP address is a private address (10.*.*.*, 192.168.*.*, 172.16.*.* -172.31.*.*). Legitimate inbound traffic will have a valid source IP.

A discussion of the importance to the community of egress filtering can be found at http://www.sans.org/y2k/egress.htm (Chris Brenton).

Network Firewall

Signal 9's ConSeal PC Firewall is an IP filtering firewall, i.e. it works at the packet level. It is designed to control the flow of packets based the source, destination, port and packet type information contained in each packet. All traffic is blocked, unless specifically permitted by a firewall rule. Network filters are quicker than the alternatives (e.g. proxy firewalls, stateful firewalls), but do not provide extensive useful logging, and may be compromised by an attacker (by using a permitted service, such as http, to tunnel banned traffic, such as Internet Relay Chat [IRC]).

So, while ConSeal PC Firewall can block communication, it does not inspect the content of the datagram. This underlines the importance of the anti-virus software, and of internet content software (such as NetNanny or SurfControl).

The default setting on the Network Firewall will be to deny all traffic. The initial installation of ConSeal PC FIREWALL permits few services (For instance, outgoing ICMP echo requests and incoming replies are allowed). For maximum efficiency, a Firewall Rulebase will have a small Rulebase (i.e. less than 30 rules). An effective way to generate a suitable Firewall Rulebase is to start with this limited default installation in a test environment, and to use the learning mode to monitor the traffic that attempts to pass through. A decision can then be made on a service-by-service basis, about whether to allow a particular service. After a few days of additions and testing, the Firewall could be put into production, where careful monitoring would be necessary for the first week, to ensure that no essential services were being blocked.

This approach is best combined with an understanding of some popular vulnerabilities. SANS (http:\\www.sans.org) has a list of blocking instructions for the top ten security vulnerabilities. But because some of these blocking instructions may disable needed services, it is important to decide on each one in turn. The test period mentioned earlier provides an ideal opportunity to decide whether or not to implement each of the following blocking instructions:

(1) Block "spoofed" addresses – packets coming from outside your company sourced from internal addresses or private (RFC1918 and network 127) addresses. Also block source routed packets.
(2) Login services – telnet (23/tcp), SSH (22/tcp), FTP (21/tcp), NetBIOS (139/tcp), rlogin et al (512/tcp through 514/tcp).
(3) RPC and NFS – Portmap/rpcbind (111/tcp and 111/udp), NFS (2049/tcp and 2049/udp), lockd (4045/tcp and 4045/udp).
(4) NetBIOS in WindowsNT – 135 (tcp and udp), 137 (udp), 138 (udp), 139 (tcp). Windows2000 – earlier ports plus 445 (tcp and udp).
(5) X Windows – 6000/tcp through 6255/tcp.
(6) Naming services – DNS (53/udp) to all machines, which are not DNS servers, DNS zone transfers (53/tcp) except from external secondaries, LDAP (389/tcp and 389/udp).
(7) Mail – SMTP (25/tcp) to all machines, which are not external mail relays, POP (109/tcp and 110/tcp), IMAP (143/tcp).
(8) Web – HTTP (80/tcp) and SSL (443/tcp) except to external Web servers, may also want to block common high-order HTTP port choices (8000/tcp, 8080/tcp, 8888/tcp, etc.).
(9) "Small Services" – ports below 20/tcp and 20/udp, time (37/tcp and 37/udp)
(10) Miscellaneous – TFTP (69/udp), finger (79/tcp), NNTP (119/tcp), NTP (123/tcp), LPD (515/tcp), syslog (514/udp), SNMP (161/tcp and 161/udp, 162/tcp and 162/udp), BGP (179/tcp), SOCKS (1080/tcp).

Following on from the SANS list, here are some additional blocking recommendations for this environment:

(1) NetBus 12345/tcp
Like Back Orifice, NetBus is a trojan-horse program that allows a remote user to access and control your machine by way of its Internet link.

(2) Back Orifice 31337/tcp
Here is a sample filter to block this trojan-horse.

```
Reference #42:
Block in and out
Remote Address and Mask: 10.90.24.250 / 255.255.255.255
Remote port range 1024-5000 Temp. Range
Local Address and Mask: 127.0.0.1 / 255.255.255.255
This local address is 'My Address'
Local port 31337 BO-Danger!!!
Priority 100
Applies always
```

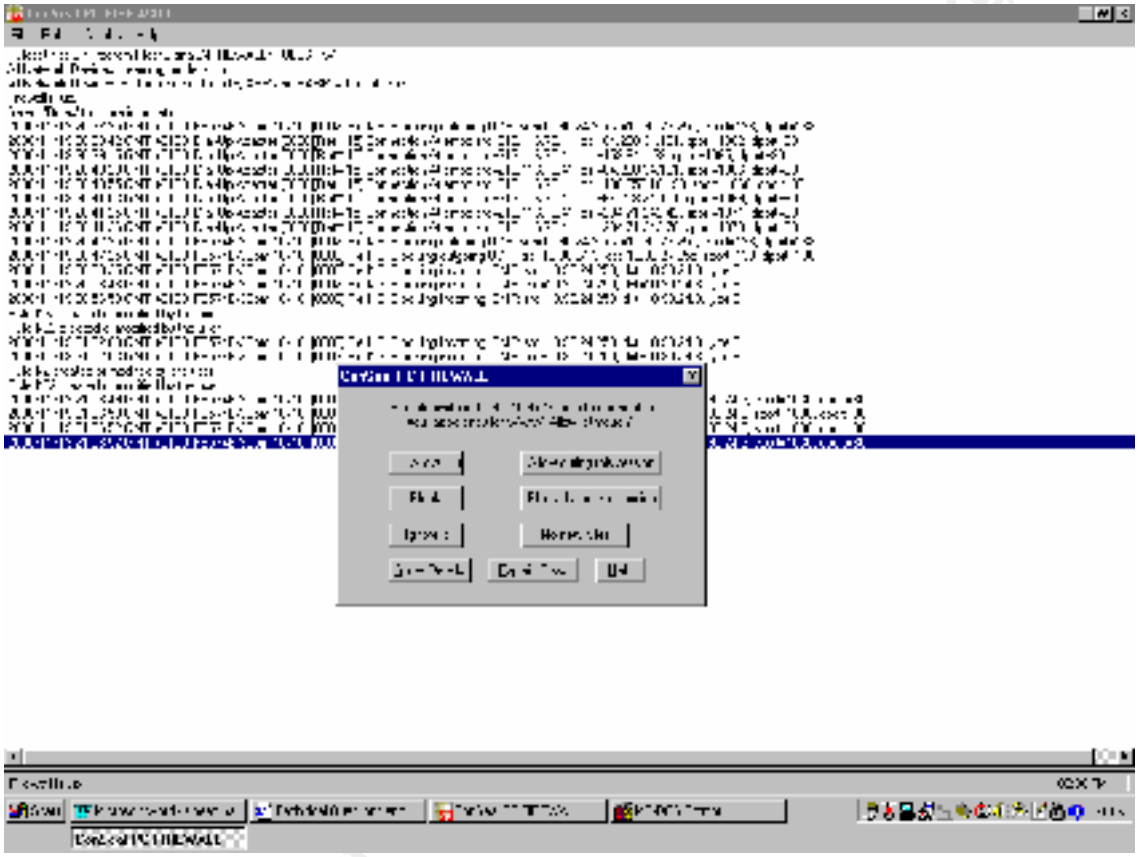
(3) Internet Relay Chat (IRC) 6660-6667/tcp
Block 6660-6667/tcp to block IRC traffic from crossing the firewall. The use of IRC has a network bandwidth cost, and may also bring the company's network to the attention of hackers.

(4) Streaming Audio 7070/tcp, 6970-7170/udp
The use of Streaming Audio (e.g. people listening to radio stations over the internet) also causes network bandwidth problems. Clients receive incoming audio streams from servers on UDP ports in the range 6970-7170. This is setup by the outgoing control connection on TCP port 7070.

(5) PowWow 13223/tcp
The "PowWow" chat program from Tribal Voice allows users to open up private chat connections with each other on this port. The program is very aggressive at trying to establish the connection and

will "camp" on the TCP port waiting for a response. This causes a connec tion attempt at regular intervals like a heartbeat.

These additional filters can be supplemented by the learning mode of the firewall. Here is an illustration of ConSeal PC FIREWALL alerting the technician that a service is requesting permission to pass through the Firewall. The technician can then choose from the following options: Allow, Allow during this session, Block, Block during this session or Ignore. ConSeal PC FIREWALL also offers further details about the service:



Using this approach, th e following Rulebase was created:

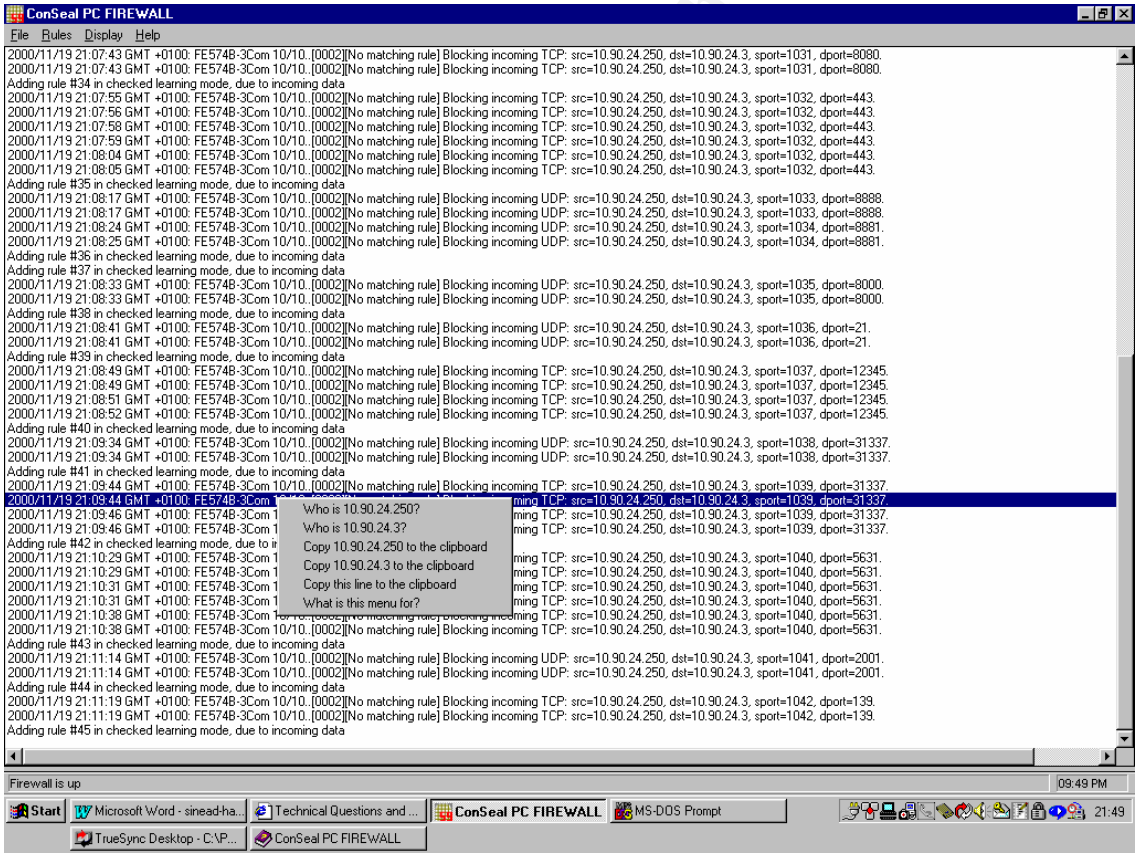
```
There is one ruleset for all network devices

Advanced:
   Protocols other than IP, ARP and RARP are blocked

Ref#   Description                                          A/B   Dir Remote
Address  Remote Mask     Remote Port  s     Local Address   Local Mask
Local Ports      Usage                   Priority Option Flags
TCP rules:
    30 Block 'Land' attack.                                 Block In Out My
Address      255.255.255.255 All Ports        My Address
255.255. 255.255 All Ports        Always                        20     w
    12 Allow Identification.                                Allow In Out All
Addresses   0.0.0.0         All Ports        My Address
255.255.255.255 Identification   Always                         90    F w
```

```
    45 TCP/IP                                                Allow In Out
10.90.24.250    255.255.255.255 Temp. Range      My Address
255.255.255.255 NetBIOS          Always                    100 * F
    43 TCP/IP                                              Block In Out
10.90.24.250    255.255.255.255 Temp. Range      My Address
255.255.255.255 PCAnywhere       Always                    100 *
    42 TCP/IP                                              Block In Out
10.90.24.250    255.255 .255.255 Temp. Range      My Address
255.255.255.255 BO -Danger!!!     Always                   100 *
    40 TCP/IP                                              Block In Out
10.90.24.250    255.255.255.255 Temp. Range      My Address
255.255.255. 255 Netbus -Danger!!! Always                  100 *
    35 TCP/IP                                              Allow In Out
10.90.24.250    255.255.255.255 Temp. Range      My Address
255.255.255.255 HTTPS            Always                    100 *    F
    34 TCP/IP                                              Allow In Out
10.90.24.250    255.255.255.255 Temp. Range      My Address
255.255.255.255 8080 -8080        Always                   100 * F
    33 TCP/IP                                             Allow In Out
10.90.24.250    255.255.255.255 Temp. Range      My Address
255.255.255.255 WWW              Always                    100 * F
    31 TCP/IP                                              Block In Out
216.52.6.120    255.255.255.255  WWW             My Address
255.255.255.255 7366 -7366        Always                   100 *
    15 Allow most Internet access (using TCP).             Allow In Out All
Addresses   0.0.0.0         All Ports        My Address
255.255.255.255 Temp . Range      Always                   100   F  C
     5 Block WinNuke, fileshares and printshares during d Block In Out All
Addresses   0.0.0.0         All Ports        My Address
255.255.255.255 NetBIOS          Dialup Active             100    l
UDP rules:
    44 UDP/IP                                              Block In Out
10.90.24.250    255.255.255.255 1041  -1041       My Address
255.255.255.255 2001 -2001        Always                   100 *
    41 UDP/IP                                             Block In Out
10.90.24.250    255.255.255.255 Temp. Range      My Address
255.255.255.255 BO -Danger!!!     Always                   100 *
    39 UDP/IP                                              Allow In Out
10.90.24.250    255.255.25 5.255 Temp. Range      My Address
255.255.255.255 Ftp              Always                    100 * F
    38 UDP/IP                                              Block In Out
10.90.24.250    255.255.255.255 Temp. Range      My Address
255.255.255.2 55 8000 -8000       Always                   100 *
    37 UDP/IP                                              Block In Out
10.90.24.250    255.255.255.255 Temp. Range      My Address
255.255.255.255 8881 -8881        Always                   100 *
    36 UDP/IP                                             Block In Out
10.90.24.250    255.255.255.255 Temp. Range      My Address
255.255.255.255 8888 -8888        Always                   100 *
     9 Allow name resolution (DNS).                       Allow In Out All
Addresses   0.0.0.0         DNS              My Address
255.255.255.255 Temp. Range      Always                   100   F
     6 Block NetBIOS during dialup.                        Block In Out All
Addresses   0.0.0.0         NetB IOS          My Address
255.255.255.255 NetBIOS          Dialup Active             100    l
     7 Allow NetBIOS (when no dialup is active).           Allow In Out All
Addresses   0.0.0.0         NetBIOS          All Addresses   0.0.0.0
NetBIOS          Always                     200   F
ICMP rules:
```

```
     2 Ping others.                                          Allow In Out All
Addresses   0.0.0.0         Ping Reply       My Address
255.255.255.255 Ping Send        Always                       10   0    F
    32 Allow ICMP Echo Reply                                 Allow In Out All
Addresses   0.0.0.0         Ping Send        My Address
255.255.255.255 Ping Reply       Always                       100    L
     3 Block ICMP nukes and more.                             Block In Out All
Addresses   0.0.0.0         All Types        All Addresses   0.0.0.0
All Types        Always                      200     w
ARP rules:
     1 Allow ARP.                                            Allow In Out All
Addresses   0.0.0.0                          All Addresses   0.0.0.0
Always                     100   F
RARP rules:
No rules, all traffic will be blocked.
```

The traffic used to test the Rulebase was generated by ISS Internet Scanner. This i s why in this example there are so many vulnerabilities expressly blocked. In reality, this is not necessary because the default setting is "No rules, all traffic will be blocked".

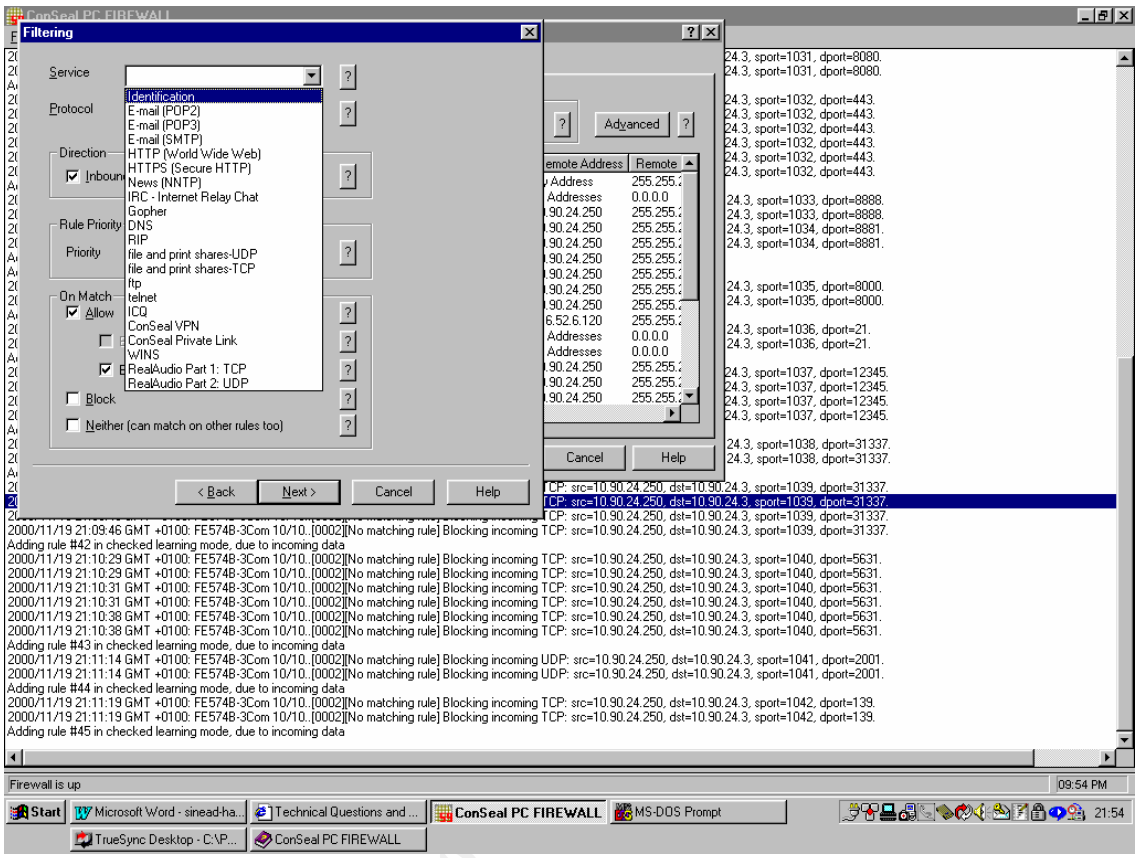
Here is an illustration of the log information generated by the ISS scan:



Note that information is provided about the source IP address, the source port, the destination IP address, the destination port, a description of the traffic and a timestamp. By right clicking an entry, the technician can do a DNS lookup to identify the hostname from the IP address.

Of course, one can also add filters manually. ConSeal PC FIREWALL offers an easy to use interface for adding new rules. In addition, one can view the syntax of the rules provided by the initial

installation. This aids understanding of the syntax. The syntax of the rules includes the Protocol (TCP/IP, UDP/IP, ICMP/IP, NetBEUI, IPX/SPX, ARP, RARP), the service (POP3, SMTP, RealAudio, telnet, ftp) to be allowed or blocked.



Once the Rulebase has been altered to includ e essential services not provided by the default installation, it is important to test the individual filters (so that essential traffic can traverse the Firewall), and the Rulebase (so that attackers cannot exploit the Firewall). Use public domain scanning tools (such as nmap) to attempt to scan the network from the Internet. Alternatively, use a commercial scanner such as Axent's NetRecon.

Firewalls can also provide protection from routing -based attacks, such as source routing and attempts to redirect routing paths to compromised sites via ICMP redirects. A firewall could reject all source - routed packets and ICMP redirects and then inform administrators of the incidents.

The order of rules in a Rulebase affects how communication is controlled. For a given packet, the Firewall compares it to the first rule in the Rulebase and if it doesn't match the specified protocol and service, the Firewall moves on to compare the packet with each following rule in turn. When the Firewall finds a match, it stops lo oking for additional matches. In this way, if there are conflicting rules for a given packet, it is the first rule loaded into the Rulebase that is applied. To guard against such errors, keep the Rulebase small and current, and test it regularly. Also, it is important to monitor the Firewall's logs to verify that the Rulebase is behaving as expected.

Assignment 3: Audit of the security architecture

A. Assessment plan

An audit is a process of review to identify configuration errors in the environment. It differs from a penetration test (where a single weakness is found and then exploited) in that the goal is to identify as many risks as possible and then to eliminate those risks.

Here is the approach I recommend:

- Begin with a baseline of normal activity, which can be gathered from the on-site technician, and from viewing the event logs.
- Identify the operating system levels and patch levels across the company's environment. Consistent software revision levels make an attacker's job more difficult (it limits the exploits available to him), and the company's technician's job easier (with fewer revision levels to consider, it is easier to focus on and act on relevant security alerts).
- Identify those staff members who have dedicated Information Security responsibilities.
- Gather all relevant documentation (such as Security Policy, Security Procedures Document, Firewall configuration document, Firewall procedures document, Network diagrams, and Employee handbook).
- Arrange a suitable time to carry out the audit. Although network analysis tools can create performance problems if run at peak times, it is important to have access to the on-site personnel, so the audit is likely to be carried out during normal business hours.
- The costs of performing the audit (in terms of the time of internal and external personnel) must be balanced against the thoroughness of the tests. Three days is enough to identify a task list of urgent things to attend to. It is prudent to budget for two people (ideally, if the budget allows, one of these will be external to the company) for three days.
- Get agreement from the on-site IT staff to have a closing meeting to discuss the results, and then for the on-site staff to follow up any outstanding points, e.g. investigate unexplained open ports.
- Some audit tools (e.g. Axent's NetRecon and ISS Internet Scanner) are expensive. In many cases, alternative tools are available in the public domain.
- Identify the risks in performing the audit, and communicate these risks to management at the company. Vulnerability scanning tools can have unpredictable results, e.g. a Denial of Service (DOS) attack against the company itself. Network performance may be negatively affected by audit tool activity. Password cracking tools may violate user privacy. It is important to get written approval for the audit from the company's management before beginning any work.

Here is a plan to test all of the VISA requirements:

1. Install and maintain a working network firewall to protect data accessible via the Internet.

- Using the Rulebase documentation, attempt to pass traffic through the Firewall that should be blocked. The audit is verifying that the Firewall has been correctly configured. For example, while a certain type of traffic is prohibited by a Firewall rule, the position of the rule in the Rulebase might prevent the rule from being triggered.
- Run a vulnerability scanner (such as Axent's NetRecon) on the network from outside the firewall. The results of this scan will further test the existing configuration, and will also suggest additional services to block.
- Run a port scanner such as nmap against the firewall.
- Check that the software revision level of the Firewall is up-to-date, to avoid unnecessary vulnerabilities.

- Assess whether there are procedures in place to amend the firewall's Rulebase. If there are none, the environment is vulnerable to a social engineering attack, where an attacker could simply call the firewall administrator, and ask for a particular service to be allowed. The traffic that a firewall should block (e.g. Internet Relay Chat – IRC) should be listed in the company's security policy.
- Assess whether the company's security team has a good idea of baseline network activity, through regular monitoring of system and security application logs, and through regular monitoring of the open ports on systems (using 'netstat –a').
- Assess whether the Firewall's underlying operating system has been hardened to become a bastion host. If the underlying operating system security is weak, then the Firewall's Rulebase can be easily circumvented.

2. Keep security patches up-to-date.

- Prepare a list of the company's installed operating systems and security software (BIND, Firewall, Anti-virus software, Content monitoring software). Using this list, do a web-search for the latest available software revision levels, and for any known vulnerability, and compare the information with the installed software.

3. Encrypt stored data accessible from the Internet.

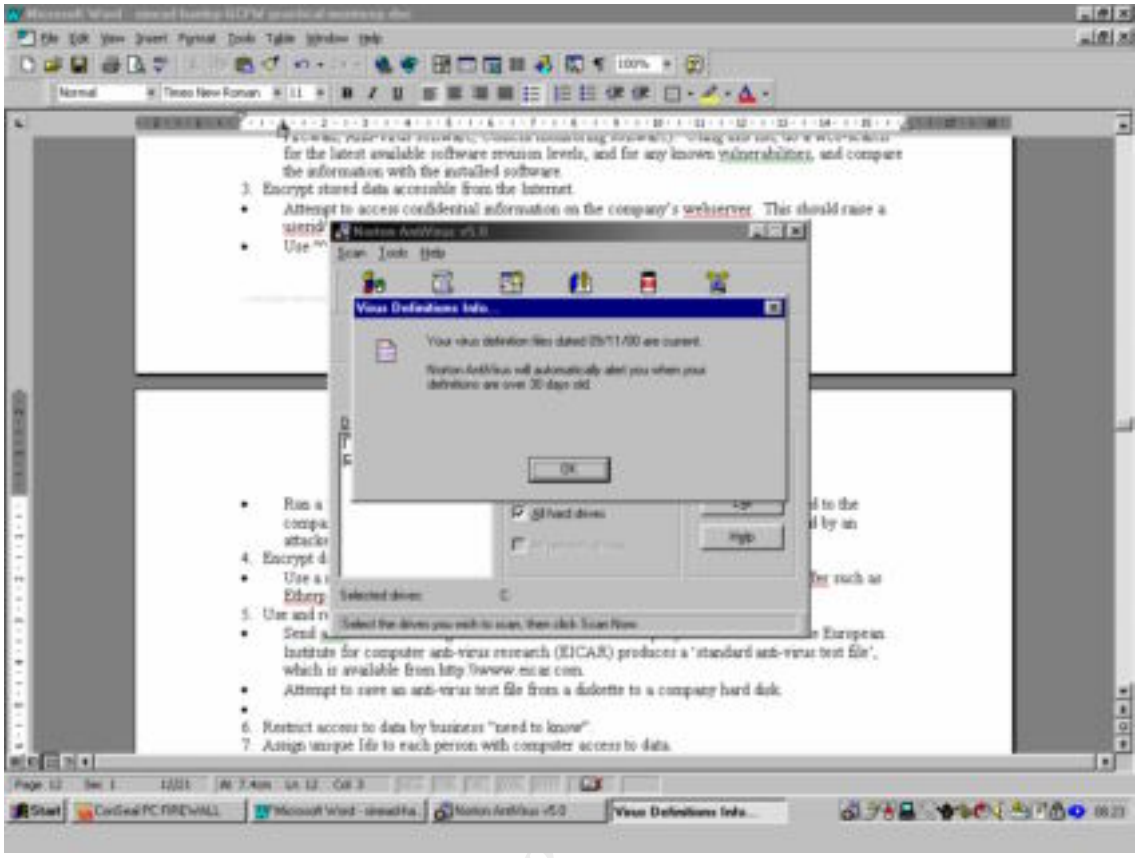
- Attempt to access confidential information on the company's webserver. This should raise a userid/password challenge.
- Use a tool like 'sental' to search for unprotected shares on the internal networks.
- Run a wardialer (such as toneloc, or phonesweep) against the range of telephone numbers assigned to the company. This will identify any modems set to auto-answer, which could be used by an attacker to access confidential information.

4. Encrypt data sent across networks.

- Use a network sniffer (either the free tcpdump/windump, or purchase a commercial sniffer such as Etherpeek or Observer) to analyse traffic across the network.

5. Use and regularly update anti-virus software.

- Send an e-mail containing an anti-virus test file to a company e-mail address. The European Institute for computer anti-virus research (EICAR) produces a 'standard anti-virus test file', which is available from http: \\www.eicar.com.
- Attempt to save an anti-virus test file from a diskette to a company hard disk.
- Check how recent the installed anti-virus software is. If the anti-virus engine is not up-to-date, it may not be able to make full use of the latest anti-virus signatures.
- Check how recent the installed anti-virus signatures are across a sample of the company's machines. This sample should include a machine from a mobile worker. Here is an illustration of a query on the age of the anti-virus signatures:



6. Restrict access to data by business "need to know".
- Check which NT groups have been created, and which users are in each group, using either the standard net.exe, or if you have access to the NT resource kit, use addusers.exe, which documents both local and global accounts.
- Attempt to access a file that should be restricted to users in the Administrator group, while logged in as a standard user.

7. Assign unique IDs to each person with computer access to data.
- Check the written procedures used by the IT staff to create user IDs to assess whether unique IDs are emphasised.
- Question a random sample of users to assess that unique IDs are actually assigned.
- Ask the IT staff whether any there are any pool user IDs, 'visitor' for instance.
- Use 'NTlast' to check the logon information for signs of an account being used by more than one person.

8. Track access to data by unique ID.
- Ensure that NT auditing has been turned on.
- Ensure that there is a written list of those files that are confidential, and whose access must be logged.
- Ask to see the logs for these confidential files, and assess whether there is a process in place to escalate failed access attempts. The re are many security tools available, but the most secure environment is one where as much of the audit effort as possible is automated, with exceptions reported to on -site IT staff. In this way, the burden on staff to manually look through log files is lessened.

9. Don't use vendor -supplied defaults for system passwords and other security parameters.
- If management have given written permission, run a password cracker against the password file. Some commercial vulnerability scanners (e.g. Axent's NetReco n) include password cracking as an option, but there are also powerful tools available for free in the public domain,

e.g. l0phtcrack (available from http: \\www.l0pht.com). Beware of unintentionally locking users' accounts if the maximum number of permitted wrong attempts is reached.

- Check the guidelines that users are given about setting passwords, to establish whether they are encouraged to set strong passwords. However, as the Germans say "Vertrauen ist gut; Kontrolle ist besser".
- Ask for a new user account to be created, and attempt to set a new password to see the password setting controls first hand.
- Ask whether passfilt.dll has been implemented, or whether the administrator has written a custom filter of his own to harden the password controls.

10. Regularly test security systems and processes.

- Look for evidence of regular self-tests by the on-site IT staff, using publicly available tools such as nmap and tcpdump.
- Attempt some social engineering, by telephoning the IT desk, and asking for a password to be reset. Ideally, this attempt should reveal that the company's staff are regularly briefed about and tested on security issues.
- Without a company culture that emphasises the importance of Information Security, any controls put in place are open to abuse from employees. Assess security awareness within the company by speaking with some employees. Security awareness can be raised through posters, through lunchtime sessions, through competitions, through e-mail updates, and through spot checks with penalties. For example, if a company has a clear desk policy (physical security is equally important as logical security), one could confiscate any documents/keys found lying on desks when people have gone home. The penalty for violating the clear desk policy could be that a person needs to get his manager to send an e-mail to the security team to get the document back.

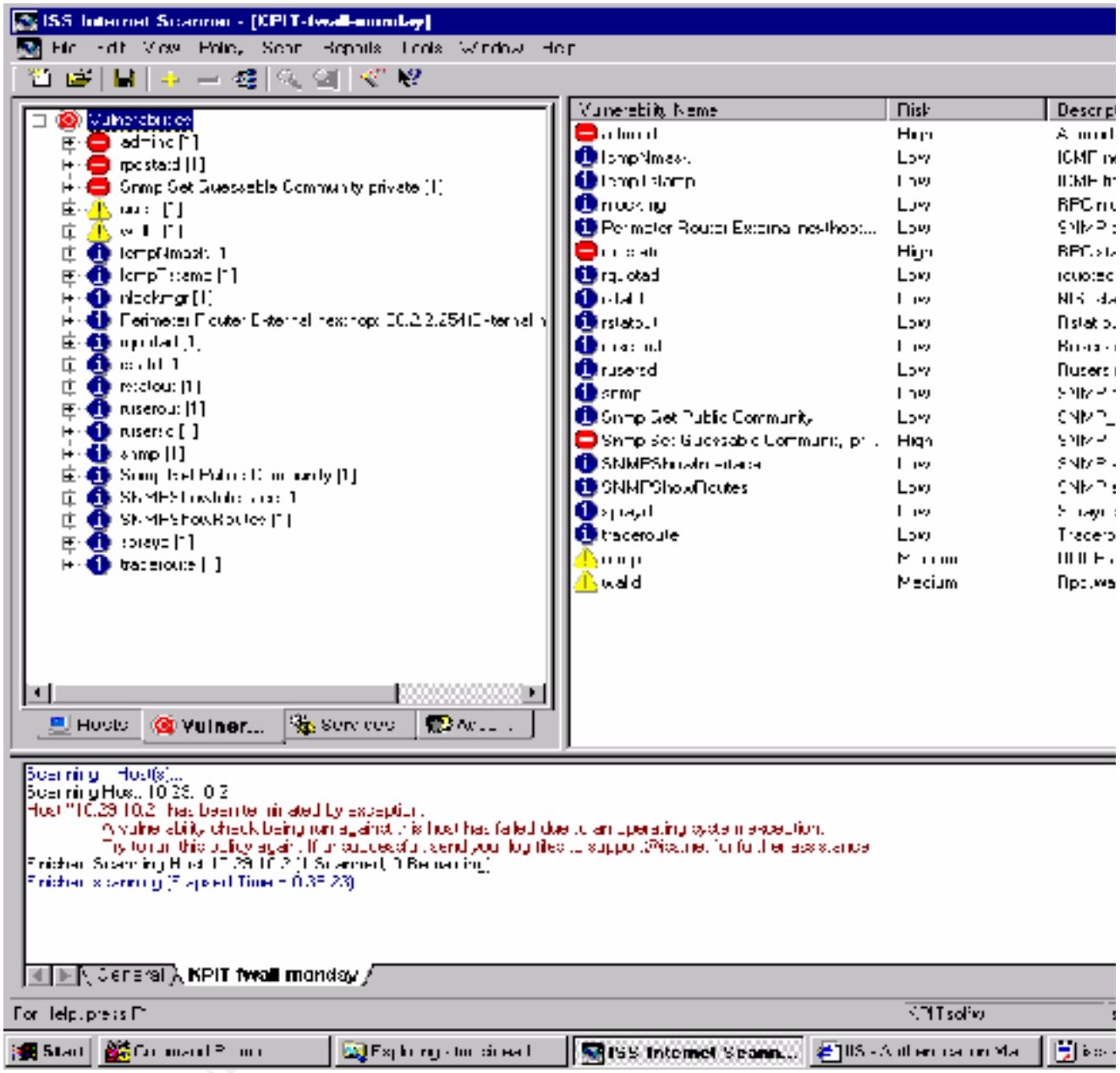
B. Implement assessment

To confirm that the firewall & perimeter router are actually implementing the security policy, I would use the commercial scanner: ISS Internet Scanner.

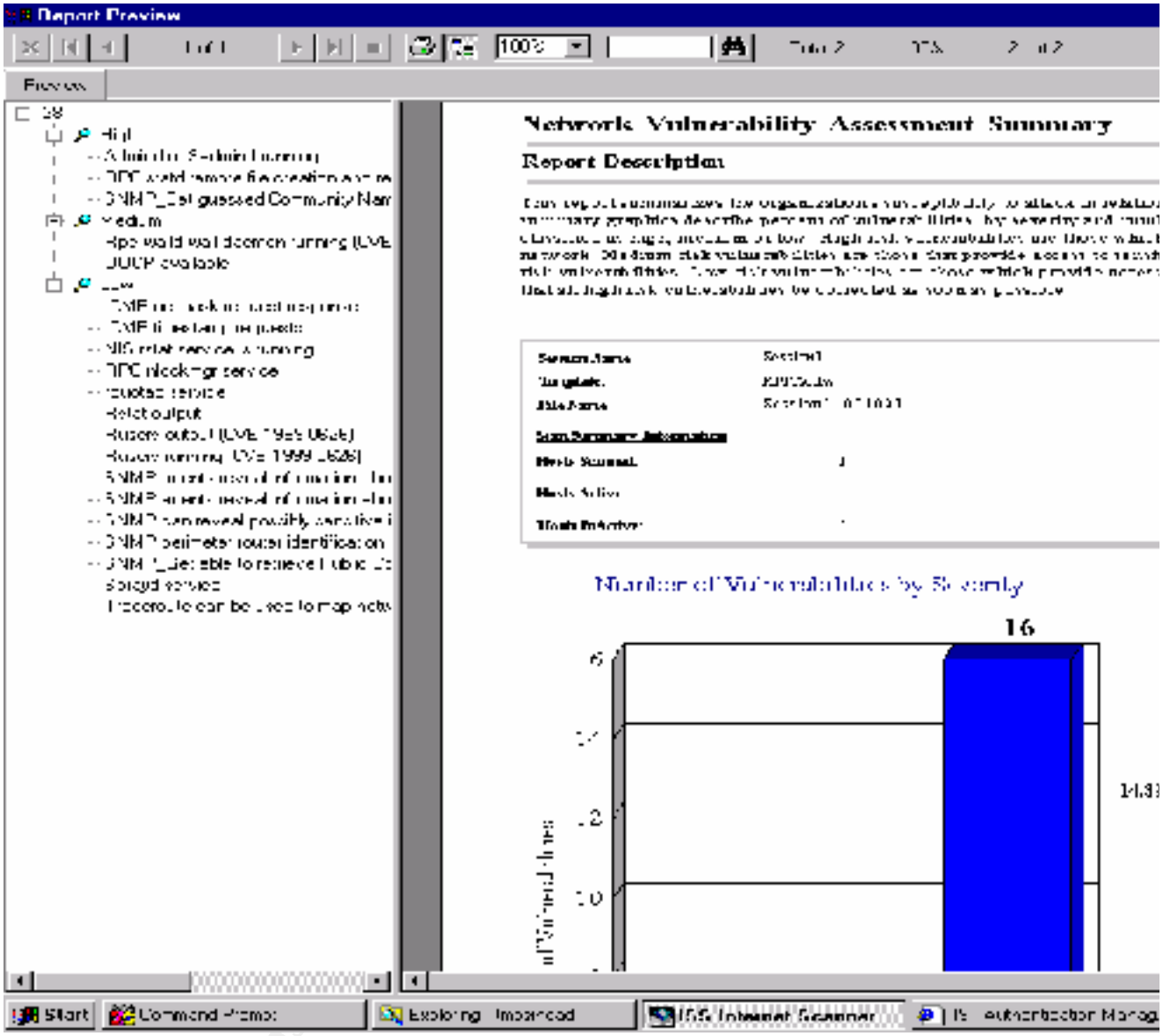
This scanner uses profiles to configure which tests to perform. There are two key dimensions to the security audit: 1. Verify that there are no configuration errors in the environment, i.e. make sure that certain traffic is actually being blocked if everyone thinks that it is being blocked. 2. Suggest ways to improve the current configuration, based on industry best practice and on an analysis of the audit logs.

I would create an ISS Internet Scanner profile to test the existing configuration: a level three NT scan with both Brute Force and Denial of Service options turned off. Using the Brute Fore option can lead to accounts being locked out en masse. It would be equally unpleasant if one of the 79 possible Denial of Service attacks succeeded during business hours (and as this is an e-commerce environment, there are no restrictions on business hours).

Here is an illustration of the ISS Internet Scanner interface:



The ISS reports option allows reports of varying detail to be created in a range of languages. Here is an example of an Executive vulnerability report:



This report on the Online Fortune Cookie Company will highlight different vulnerabilities, because the Firewall scanned in the above illustr ation is running Solaris 2.6, instead of MS WindowsNT.

While the ISS scan is running, I would work through the steps listed above to test VISA's 'ten commandments'.

C. Perimeter analysis

The perimeter defence depends on the Firewall Rulebase being corre ctly configured, and it also depends on the IT staff making the necessary changes to protect against new vulnerabilities.

Using a 'defence in depth' approach, I would recommend that:

- Each internal host machine be hardened using one of many available harde ning guides, e.g. the SANS step-by-step guide at http://www.sans.org/newlook/publications/ntstep.htm .

- The results of the ISS scan be followed up, e.g. to investigate whether each runnin g service is a required service. This process should result in changes to the configuration to reflect the any vulnerabilities.
- Employee awareness of security be raised.
- A hardware support contract be arranged, so that should the firewall or border router need to be serviced, a replacement could be provided within an agreed amount of time, and the business' revenue would not be jeopardised.
- There be a weekly review of the Firewall logs to ensure that the Rulebase is behaving as expected, and to look for pa tterns of suspicious activity.
- Someone be made responsible for Information Security in the environment. This gives the rest of the company a focal point, and it means that security issues are less likely to fall to the bottom of everyone's priority list.

APPENDIX 1: DETAILED RULEBASE for ConSeal PC FIREWALL

```
Ruleset file for ConSeal PC FIREWALL
Created on Windows 95/98, file format v1.2

Firewall State:
   Firewall is Up
   Logging is on
   Start in the deskto p (not SysTray)

Ruleset Scope:
   One Ruleset for All Network Devices

Ruleset Usage:
   Always

Password:
   Password not used

There is one ruleset for all network devices

Next Reference Number: 46

Learning mode: Checked (the user is prompted when new   traffic is found)

Advanced:
   Protocols other than IP, ARP and RARP are blocked

TCP rules:
Traffic using this protocol that does not match a rule will be blocked

Reference #30:
Block 'Land' attack.



Description: This attack tries to make your system

connect to itself, causing it to stop responding and

requiring a reboot.



Details: The Priority of 20 makes it take precedence

of other rules. The remote address is 'My Address'

because the attack spoofs it to make it appear to have

come from your  system.
Service: Identification
Block in and out
Remote Address and Mask: 127.0.0.1 / 255.255.255.255
This remote address is 'My Address'
Remote port range 0 -65535 All Ports
Local Address and Mask: 127.0.0.1 / 255.255.255.255
This local address is 'My Addr ess'
Local port range 0 -65535 All Ports
Priority 20
```

```
Applies always
Options:
   F - block fragments (takes effect only on allow rules)
   w - Log Once (warn, no more than once every 2 seconds)

Reference #12:
Allow Identification.

Description: Some systems  require your identity before

allowing you to access services, such as email and IRC.



Details: The remote system makes an incoming connection

so this rule allows incoming connections. The Warning

beep is on so you know when your identity is being

accessed.
Service: Identification
Allow in and out
Remote Address and Mask: 255.255.255.255 / 0.0.0.0
This is all remote addresses
Remote port range 0 -65535 All Ports
Local Address and Mask: 127.0.0.1 / 255.255.255.255
This local address is 'My Address'
Local port 113 Identification
Priority 90
Applies always
Options:
   F - block fragments (takes effect only on allow rules)
   w - Log Once (warn, no more than once every 2 seconds)

Reference #45:
Allow in and out
Remote Address and Mask: 10.90.24.250 / 255.2  55.255.255
Remote port range 1024 -5000 Temp. Range
Local Address and Mask: 127.0.0.1 / 255.255.255.255
This local address is 'My Address'
Local port 139 NetBIOS
Priority 100
Applies always
Options:
   * - rule was made in learning mode
   F - block fragmen ts (takes effect only on allow rules)

Reference #43:
Block in and out
Remote Address and Mask: 10.90.24.250 / 255.255.255.255
Remote port range 1024 -5000 Temp. Range
Local Address and Mask: 127.0.0.1 / 255.255.255.255
This local address is 'My Address'
Local port 5631 PCAnywhere
Priority 100
Applies always
Options:
   * - rule was made in learning mode
   F - block fragments (takes effect only on allow rules)
```

```
Reference #42:
Block in and out
Remote Address and Mask: 10.90.24.250 / 255.255.255.255
Remote port range 1024 -5000 Temp. Range
Local Address and Mask: 127.0.0.1 / 255.255.255.255
This local address is 'My Address'
Local port 31337 BO -Danger!!!
Priority 100
Applies always
Options:
   * - rule was made in learning mode
   F - block fragments (takes eff ect only on allow rules)

Reference #40:
Block in and out
Remote Address and Mask: 10.90.24.250 / 255.255.255.255
Remote port range 1024 -5000 Temp. Range
Local Address and Mask: 127.0.0.1 / 255.255.255.255
This local address is 'My Address'
Local port 1234 5 Netbus -Danger!!!
Priority 100
Applies always
Options:
   * - rule was made in learning mode
   F - block fragments (takes effect only on allow rules)

Reference #35:
Allow in and out
Remote Address and Mask: 10.90.24.250 / 255.255.255.255
Remote port ran ge 1024 -5000 Temp. Range
Local Address and Mask: 127.0.0.1 / 255.255.255.255
This local address is 'My Address'
Local port 443 HTTPS
Priority 100
Applies always
Options:
   * - rule was made in learning mode
   F - block fragments (takes effect only on all  ow rules)

Reference #34:
Allow in and out
Remote Address and Mask: 10.90.24.250 / 255.255.255.255
Remote port range 1024 -5000 Temp. Range
Local Address and Mask: 127.0.0.1 / 255.255.255.255
This local address is 'My Address'
Local port 8080 8080 -8080
Priority 100
Applies always
Options:
   * - rule was made in learning mode
   F - block fragments (takes effect only on allow rules)

Reference #33:
Allow in and out
Remote Address and Mask: 10.90.24.250 / 255.255.255.255
Remote port range 1024 -5000 Temp. Rang e
Local Address and Mask: 127.0.0.1 / 255.255.255.255
This local address is 'My Address'
Local port 80 WWW
Priority 100
Applies always
```

```
Options:
   * - rule was made in learning mode
   F - block fragments (takes effect only on allow rules)

Reference #31:
Block in and out
Remote Address and Mask: 216.52.6.120 / 255.255.255.255
Remote port 80 WWW
Local Address and Mask: 127.0.0.1 / 255.255.255.255
This local address is 'My Address'
Local port 7366 7366 -7366
Priority 100
Applies always
Options:
   * - rule was made in learning mode
   F - block fragments (takes effect only on allow rules)

Reference #15:
Allow most Internet access (using TCP).



Description: This rule allows you to do web browsing,

email, IRC and most other (TCP -based) services. The

rule is  not made to allow others to access services

on your system.



Details: The local port range, 1024 -5000, is all you

usually need to access remote services. Most services

on your system are in the range 1 -1023. Incoming

connections are allowed so DCC a nd FTP will work.

If you block incoming connections, use FTP PASV mode.
Allow in and out
Remote Address and Mask: 255.255.255.255 / 0.0.0.0
This is all remote addresses
Remote port range 0 -65535 All Ports
Local Address and Mask: 127.0.0.1 / 255.255.255.25  5
This local address is 'My Address'
Local port range 1024 -5000 Temp. Range
Priority 100
Applies always
Options:
   F - block fragments (takes effect only on allow rules)
   C - Log Connection (logs the allowed TCP connection attempts)

Reference #5:
Block WinNuke, fileshares and printshares during dialup.



Description: This rule blocks access to your hard drive
```

while you have a dialup connection active. The WinNuke attack attempts to connect (to port 139) to make your system crash. The rule is intende d to protect people while dialed out to the Internet.

Details: This rule blocks TCP port 139. It is only active during dialup. To change this, click the Next button below to see the Usage page and change when the rule applies.

```
Service: Fileshares -TCP
Block in and out
Remote Address and Mask: 255.255.255.255 / 0.0.0.0
This is all remote addresses
Remote port range 0 -65535 All Ports
Local Address and Mask: 127.0.0.1 / 255.255.255.255
This local address is 'My Address'
Local port 139 NetBIOS
Priority 10 0
Applies when dialup is active
Options:
   F - block fragments (takes effect only on allow rules)
   l - Log Once (log blocked packets, no more than once every 2 seconds)

UDP rules:
Traffic using this protocol that does not match a rule will be blocked

Reference #44:
Block in and out
Remote Address and Mask: 10.90.24.250 / 255.255.255.255
Remote port 1041 1041 -1041
Local Address and Mask: 127.0.0.1 / 255.255.255.255
This local address is 'My Address'
Local port 2001 2001 -2001
Priority 100
Applies always
Options:
   * - rule was made in learning mode
   F - block fragments (takes effect only on allow rules)

Reference #41:
Block in and out
Remote Address and Mask: 10.90.24.250 / 255.255.255.255
Remote port range 1024 -5000 Temp. Range
Local Address and Mask : 127.0.0.1 / 255.255.255.255
This local address is 'My Address'
Local port 31337 BO -Danger!!!
Priority 100
Applies always
Options:
   * - rule was made in learning mode
   F - block fragments (takes effect only on allow rules)

Reference #39:
```

```
Allow in and  out
Remote Address and Mask: 10.90.24.250 / 255.255.255.255
Remote port range 1024 -5000 Temp. Range
Local Address and Mask: 127.0.0.1 / 255.255.255.255
This local address is 'My Address'
Local port 21 Ftp
Priority 100
Applies always
Options:
   * - rule was made in learning mode
   F - block fragments (takes effect only on allow rules)

Reference #38:
Block in and out
Remote Address and Mask: 10.90.24.250 / 255.255.255.255
Remote port range 1024 -5000 Temp. Range
Local Address and Mask: 127.0.0.1 / 255.255.  255.255
This local address is 'My Address'
Local port 8000 8000 -8000
Priority 100
Applies always
Options:
   * - rule was made in learning mode
   F - block fragments (takes effect only on allow rules)

Reference #37:
Block in and out
Remote Address and Ma sk: 10.90.24.250 / 255.255.255.255
Remote port range 1024 -5000 Temp. Range
Local Address and Mask: 127.0.0.1 / 255.255.255.255
This local address is 'My Address'
Local port 8881 8881 -8881
Priority 100
Applies always
Options:
   * - rule was made in learnin g mode
   F - block fragments (takes effect only on allow rules)

Reference #36:
Block in and out
Remote Address and Mask: 10.90.24.250 / 255.255.255.255
Remote port range 1024 -5000 Temp. Range
Local Address and Mask: 127.0.0.1 / 255.255.255.255
This local  address is 'My Address'
Local port 8888 8888 -8888
Priority 100
Applies always
Options:
   * - rule was made in learning mode
   F - block fragments (takes effect only on allow rules)

Reference #9:
Allow name resolution (DNS).



Description: This rule al lows your system to ask your

DNS server to translate a name like 'www.signal9.com'
```

to an IP address like 195.151.12.15. This is neccessary

for web browsing and most other services.

Details: Most attacks are based on sending fragments.

This rule bloc ks fragments, so you should be safe.

Most Internet users talk to DNS servers provided by

their ISP.
Service: DNS
Allow in and out
Remote Address and Mask: 255.255.255.255 / 0.0.0.0
This is all remote addresses
Remote port 53 DNS
Local Address and Mask: 1 27.0.0.1 / 255.255.255.255
This local address is 'My Address'
Local port range 1024 -5000 Temp. Range
Priority 100
Applies always
Options:
   F - block fragments (takes effect only on allow rules)

Reference #6:
Block NetBIOS during dialup.

Description: Your system announces its presence on a

network when it connects. There is no need to send this

to the Internet.

Details: This rule applies when dialup is active. It is

intended to protect people dialing in to the Internet.

To change it, select the Next button to get to the

Usage page and change when the rule applies. The

Priority value is 100 so it takes precedence over rule

7, which would allow NetBIOS otherwise.
Service: Fileshares -UDP
Block in and out
Remote Address and Mask: 255.255.255.255 /   0.0.0.0
This is all remote addresses
Remote port range 137 -138 NetBIOS
Local Address and Mask: 127.0.0.1 / 255.255.255.255
This local address is 'My Address'
Local port range 137 -138 NetBIOS
Priority 100
Applies when dialup is active
Options:

```
   F - block fragments (takes effect only on allow rules)
   l - Log Once (log blocked packets, no more than once every 2 seconds)

Reference #7:
Allow NetBIOS (when no dialup is active).



Description: This rule allows your system to announce

its presence. It is on ly used when you are not dialed

out.



Details: The Priority is 200, which means rule 6 takes

precedence when dialup is active. This rule will only

allow with dialup is inactive and rule 6 is not in use.
Service: Fileshares -UDP
Allow in and out
Remote Address and Mask: 255.255.255.255 / 0.0.0.0
This is all remote addresses
Remote port range 137 -138 NetBIOS
Local Address and Mask: 255.255.255.255 / 0.0.0.0
This is all local addresses
Local port range 137 -138 NetBIOS
Priority 200
Applies always
Options:
   F - block fragments (takes effect only on allow rules)

ICMP rules:
Traffic using this protocol that does not match a rule will be blocked

Reference #2:
Ping others.



Description: This rule allows you to ping others.



Details: The local type allows  'Ping request' out

and the remote type allows 'Ping Reply' in. The

Priority is 100 so this rule takes precedence over

rule 3, which will block all ICMP (including nukes).
Allow in and out
Remote Address and Mask: 255.255.255.255 / 0.0.0.0
This is all re mote addresses
Incoming type 0 Ping Reply
Local Address and Mask: 127.0.0.1 / 255.255.255.255
This local address is 'My Address'
Outgoing type 8 Ping Send
Priority 100
```

```
Applies always
Options:
   F - block fragments (takes effect only on allow rules)

Reference #32:
Allow ICMP Echo Reply
Allow in and out
Remote Address and Mask: 255.255.255.255 / 0.0.0.0
This is all remote addresses
Incoming type 8 Ping Send
Local Address and Mask: 127.0.0.1 / 255.255.255.255
This local address is 'My Address'
Outgoing type  0 Ping Reply
Priority 100
Applies always
Options:
   L - Log Always (log all packets blocked by this rule)

Reference #3:
Block ICMP nukes and more.



Description: This rule blocks all ICMP types not

allowed by other rules. It blocks the ICMP nuke that

makes your system disconnect from services like IRC.



Details: The Priority of 200 means rule 2 takes

precedence. If ICMP is recieved and it is not ping

reply, this rule will block it. This rule is important

because it blocks ICMP type 3 which is the   basis of

many attacks that disconnect you from services.


Block in and out
Remote Address and Mask: 255.255.255.255 / 0.0.0.0
This is all remote addresses
Incoming type range 0 -255 All Types
Local Address and Mask: 255.255.255.255 / 0.0.0.0
This is all local addresses
Outgoing type range 0 -255 All Types
Priority 200
Applies always
Options:
   F - block fragments (takes effect only on allow rules)
   w - Log Once (warn, no more than once every 2 seconds)

ARP rules:
Traffic using this protocol that does n  ot match a rule will be blocked

Reference #1:
Allow ARP.
```

Description: This rule allows your system to know how

to reach others. It is allowed because it is not the

basis of any known attacks.

Details: Blocking ARP effectively makes you unreachable .

This rule should not be changed unless you really have

to and know what you are doing. It is pretty safe.
Allow in and out
Remote Address and Mask: 255.255.255.255 / 0.0.0.0
This is all remote addresses
Local Address and Mask: 255.255.255.255 / 0.0.0.0
This is all local addresses
Priority 100
Applies always
Options:
   F - block fragments (takes effect only on allow rules)

RARP rules:
No rules, all traffic will be blocked.