Global Information Assurance Certification Paper

Auditing the NetScreen Secure Access SA-3000 Series SSL VPN Appliance

(Formerly Neoteris IVE 3020)

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Disclaimer

The following document contains information that is based on an actual SA-3000 that is currently in production at my current place of employment. Considering that this information is extremely confidential, all IP addresses, hostnames, and references made to the company have been altered or removed for their protection. Actual text and all screen shots used within this document have also been altered to protect the company.

1. Assignment 1 – Research in Audit, Measurement Practice, and Control

1.1 Introduction

Acme Corporation has tasked me to conduct an audit of their SSL VPN infrastructure, which primarily consists of one hardware component. The component is known as the NetScreen Secure Access SA-3000 series SSL VPN appliance, formerly known as the Neoteris Instant Virtual Extranet 3020. Acme Corporation would like to know if the SA-3000 operates as securely as the vendor claims. To fulfil this requirement, I've decided to test two scopes:

1. Secure connectivity between a PC connected to the Internet and the SA-3000 which is located at the customer's site. To conduct this test, I will use the primary application that Acme employees connect to; OWA (Outlook Web Access).
2. The second objective of this security audit is to ensure that the NetScreen SSL VPN appliance itself is in fact a secure device.

Throughout this audit, we will assume that all other components that are part of the SSL VPN formation are secured and without compromise. This would include: the PC connected to the Internet, the firewall that constitutes a DMZ to which the SA-3000 resides, and the OWA server itself.

1.2 Description of the system being audited

The NetScreen Secure Access SA-3000 is a hardened network appliance that provides security by intermediating data stream requests that flow between requesting clients and internal resources, enforcing the use of encryption for all supported TCP sessions. It achieves this by using the following dependencies:

1. A stripped-down pre-hardened version of the Linux operating system kernel.
2. SSL (Secure Sockets Layer) protocol, originally developed by Netscape to transmit information over the Internet in an encrypted state.
3. A pre-hardened version of Apache web server with OpenSSL + Mod_SSL components.

The SA-3000 is technically designed to be used as an edge device facing the Internet directly, to allow for remote access to internal resources using a standard web browser from any location. The device has two Ethernet interfaces; an external and an internal. If being used as an edge device, both interfaces are required. If placed on a public DMZ protected by a screen router or firewall, then only one interface is to be used.

Users authenticate to the SA-3000 using a "userid" and "password." This in turn is either validated by the SA-3000's local user database or internal network authentication servers. Once a session has been established, the SA-3000 provides secure access to a multitude of internal resources such as; web-mail, web-applications, network file sharing services, and native MAPI (Messaging Application Programming Interface).

The SA-3000 operates on the basis of a term knows as “clientless VPN.” The technology is called “clientless” because it does not require the installation of additional software components (such as IPSEC) on the client PC to enable a secure session. It is a “transparent” solution that does not require additional network configuration changes on the client PC, other than what is needed for basic Internet connectivity. In this case, any standard web browser that supports SSL is the only requirement needed to connect. The browser will actually use HTTPS (HyperText Transport Protocol – Secure) which is basically HTTP over SSL/TLS.

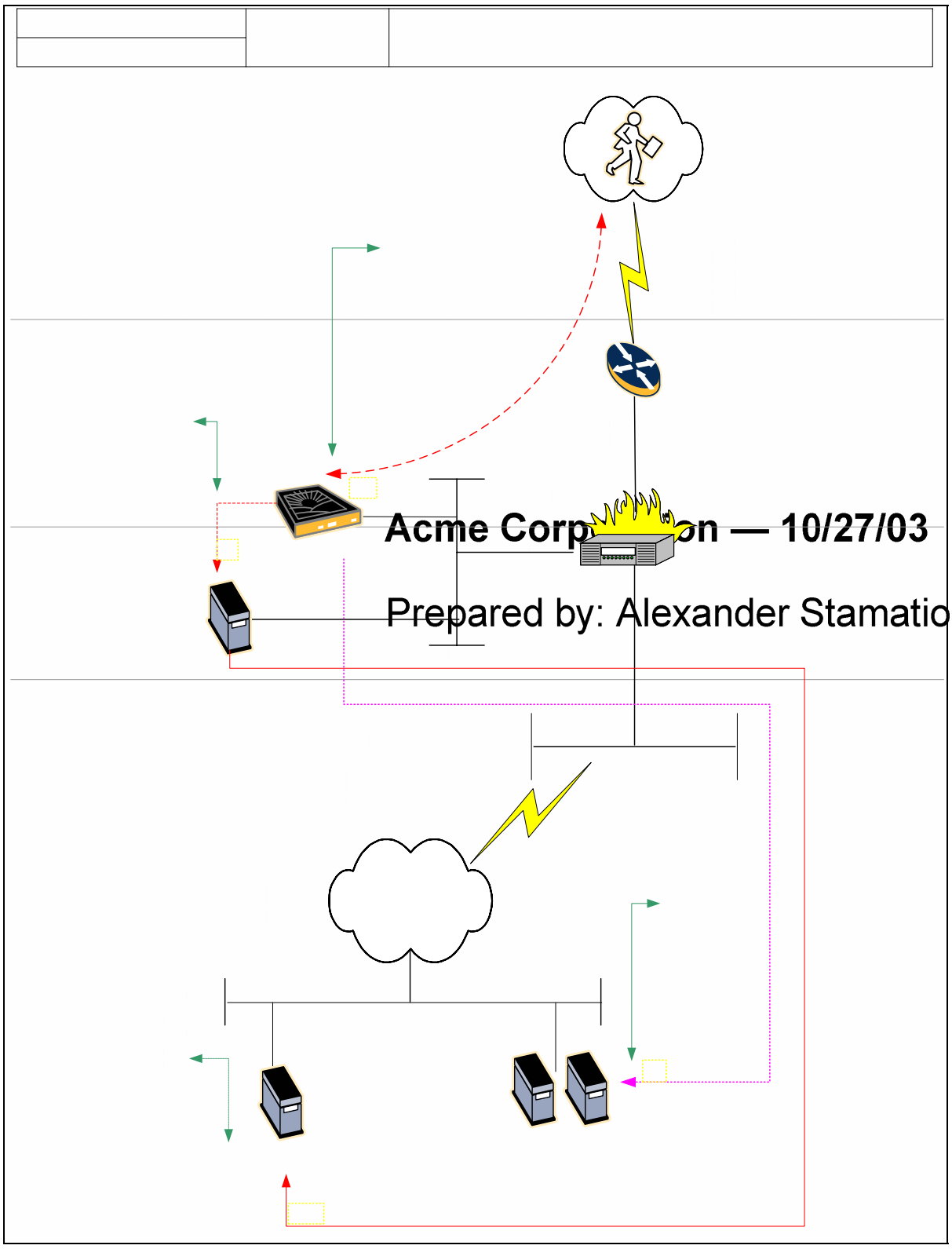
In order to establish a secure connection utilizing SSL, an exchange of encryption keys is required on behalf of the client and the SA-3000. This is accomplished by use of the RSA key-exchange algorithm and either RC4 ciphers for 128-bit connections or Triple DES ciphers for 168-bit connections. The SA-3000 also supports 40-bit and 56-bit connections. However, since the US government repealed its ban on 128-bit encryption in 1997, this audit will primarily focus on connections that are 128-bit or greater. The supported SSL versions are; 2.0, 3.0, and TLS (Transport Layer Security), all options are configurable administrative options.

User authentication is achieved by either of the following options; SA-3000 internal database, Radius, LDAP/LDAPS, Windows Active Directory, Netegrity SiteMinder, or RSA ACE Server.

Acme Corporation SA-3000 Configuration:

In the case of Acme Corporation, the SA-3000 resides on a DMZ protected by a Checkpoint firewall. Only one Ethernet interface on the SA-3000 is active, since it is not being used as an edge device. The firewall is configured to redirect all incoming HTTP (tcp/port 80) and HTTPS (tcp/port 443) connections destined for *<extranet.acme.com>* to the SA-3000. The registered DNS name <*extranet.acme.com*> resolves to a publicly assigned IP address. All incoming web-mail requests are redirected to the Checkpoint firewall (via proxy ARP), which in turn uses NAT (Network Address Translation) to hide the real (private) IP address of the SA-3000. Authentication is off-loaded to internal Radius servers; both a primary and a secondary for redundancy. The SA-3000 is configured to only accept SSL/TLS version 3 connections, and it forces the client browser to use Triple DES 168-bit encryption. The only application that is currently accessible via the SA-3000 is a Microsoft OWA server for web-mail services. The OWA server also resides on the DMZ; it is securely hardened and only accepts connections from the SA-3000. In turn, the Checkpoint firewall rules, will only allow the OWA server to connect to the Microsoft Exchange servers on the internal LAN. The only access that the SA-3000 has to the internal LAN, are the Radius servers for user authentication.

Network Diagram:



Configuration:

SA-3000 General Settings	Details
System Software Package version	3.3.1-S1 Release (build 5651)
SA-3000 Name	SA_3000
Hostname	extranet.acme.com
Internal Interface	100Mbs / Full Duplex / Auto Negotiation
Internal Interface IP	10.5.1.2
External Interface	Disabled
Static Route	0.0.0.0 >> 10.5.1.1
Web proxy	Disabled
DNS	172.16.2.1 & 172.16.2.2
Authentication Servers	Radius @ 172.16.3.1 & 172.16.3.2 Port 1645
Public IP extranet.acme.com	500.50.10.5
Allowed SSL version	SSL v3
Allowed Encryption Strength	Accept Only 168-bit
Page Caching	Off
Time Since Last Reboot	20 Days, 15 Hours, 24 Minutes, 30 Seconds
Logging Disk	10% Full
Maximum Concurrent Users Allowed	100
Sign-in password length	Minimum 6 characters
Basic Authentication Intermediation	Set to HIGH
Cache Control	No-Store
NTP Enabled	Yes
Sign-On Options	All accounts on enabled authentication servers
Administrator ID	Admin – Enabled on local
Idle Timeout	10 minutes
Max Session Length	30 minutes
Enable Roaming Session	Disabled

1.3 Risk to the system being audited

The purpose of evaluating any significant risk to the SA-3000 is to ensure that any and all potentials are properly addressed throughout the audit process. Using best practices and a well developed audit plan, any & all discovered risks are easier to analyze and provide the appropriate measures to counteract the threats. To determine the risks associated with the SA-3000, I took the following specifics into consideration:

1. The risk itself.
2. The consequences if an unauthorized user decided to use the risk in a malicious way.
3. The probability that the risk could happen.
4. The severity level if it were to happen and the outcome.

The tables below describe some of the potential security risks that the SA-3000 may be subjected to:

Risk #1	A hacker gains root access to the SA-3000 system via command-line.
Consequences	With root access the hacker has the keys to the kingdom, and the ability to change anything on the SA-3000 to his advantage. The SA-3000 uses a Linux kernel, thus any & all files or scripts can be manipulated for malicious activities.
Probability	Low Risk. The SA-3000 is a hardened OS and it's completely stripped of all & any commands, giving anyone the inability to execute a root shell.
Severity Level	High Level. The system would be completely compromised.

Risk #2	An unauthorized user gains access to the SA-3000 web-administration console from anywhere on the Internet.
Consequences	With administrative access to the web-admin console, an unauthorized user has the ability to change any and all configuration settings that apply to the operation of the SA-3000. This includes adding access to any supported resource on the LAN if the firewall has an open policy for the SA-3000 to "any."
Probability	Medium Risk. If the administrator fails to properly configure the following: does not make use of TCP Wrappers or blocked subnets, fails to change the "admin" username to something unique, utilize a cryptic password of long length, fails to create separate access rules on the firewall, and disable session roaming.
Severity Level	High Level. The system and the network would be completely compromised.

Risk #3	Persistent cookies are allowed via the SA-3000 configuration settings.
Consequences	With cookie persistence enabled, it is possible that "login" session states are stored on the connecting client machine.
Probability	Low Risk. By default the SA-3000 has cookie persistence disabled for all connections. NetScreen also warns the administrator NOT to use cookie persistence unless it is absolutely necessary, making note that security can be compromised.
Severity Level	Medium Level. A hacker can use this information as an attempt to elevate his privileges, bypass authentication, or reveal specific details about the session ID.

Risk #4	Using SSLv2, instead of v3.
Consequences	SSLv2 has well-known buffer-overflow exploits, which could allow a hacker to execute arbitrary code on the SA-3000.
Probability	High Risk. By default, the SA-3000 is configured to accept connections from both SSLv2 & v3 supported browsers. All browsers have been supporting SSLv3 for the better part of 2 years.
Severity Level	Medium Level. Using the exploits associated with SSLv2, a hacker could bypass some of the key features of the SA-3000's security control mechanisms.

Risk #5	Intent to maliciously POWER DOWN the system.
Consequences	Authorized Acme users will not have the ability to access OWA web-mail services as a result. This could be considered a denial-of-service for the corporation, and would disrupt the ability for sales employees to access mail from anywhere.
Probability	Low Risk. Every MIS employee at Acme Corporation is required to use an access card to enter the data-center. Someone would need to loose their card, or an intruder would have to try to enter via an unlocked door. The data-center is monitored via CCTV and security guards.
Severity Level	High Level. When there's a will, there's a way. Intruders could enter undetected and maliciously power down the system without any indication.

Risk #6	Radius Authentication not available.
Consequences	Acme users would not be able to authenticate to the SA-3000, thus unable to gain access to OWA.
Probability	Low Risk. The SA-3000 is configured to make use of a primary and secondary Radius server in the event that one fails. The network itself is fully redundant, thus a lack of connectivity is highly unlikely.
Severity Level	High Level. Without the ability to use Radius for authentication, access to the SA-3000 is not feasible.

Risk #7	Open ports on the SA-3000.
Consequences	Such a vulnerability would give the hacker the ability to use a multitude of exploits to compromise the SA-3000
Probability	Low Risk. The SA-3000 listens only on port 443, and does not have any other TCP ports active by design and function.
Severity Level	Medium Level. Depending on the open ports, a hacker could compromise the device using ports other than 443.

Risk #8	Gaining unauthorized access to the SA-3000 console port.
Consequences	An intruder or hacker will have the ability to compromise the device severely. From the console, the following could be executed: change configuration settings, change the admin username and password, disable TCP wrappers, reboot the system, or rollback to a previous version.
Probability	Low Risk. The intruder or hacker would need to bypass all effective physical security controls. The Acme data-center makes use of CCTV and security guard protection, aside from requiring an access card to enter.
Severity Level	High Level. The intruder or hacker could render the SA-3000 useless, or reconfigure to their advantage.

Risk #9	"dsCacheCleaner.exe" unable to install on the client machine properly.
Consequences	The ActiveX control will not be able to delete cacheable content from the client browser and all locally dependant directories. Thus, any files & content downloaded via the SA-3000 will remain on the client PC indefinitely.
Probability	High Risk: The "dsCacheCleaner.exe" will only install with local admin or power user privileges. In most cases, Acme's users do not have these rights. Hence, the cached content is most likely to stay on the local machine.
Severity Level	High Level. If shared systems are used to view attached files via OWA, those files will remain on that system as cacheable items. Anyone could potentially view this information.

1.4 Current State of Practice

The task of researching the Internet and various other resources, as a means to find secure configurations and or auditing methods for the NetScreen Secure Access SA-3000 SSL-VPN appliance proved to be very challenging. I was actually very surprised that I couldn't find "best practice" methods or audit checklists that specifically focus on the SA-3000. My best tool up to now has been my personal experiences with the device and dealing with NetScreen technical support engineers. Most of the technical information that is specific to these SSL-VPN appliances can only be found via the vendors support knowledge-base or FAQ database. Although the technical manual provides decent information on how to use the various options via the web interface, it doesn't give the reader a good understanding of the various configuration parameters. Even technical newsgroups are limited with information, and I was shocked by this. It's usually easy to find answers to questions via technical newsgroups, but not in the case of the SA-3000.

On a good note, I managed to find good audit reports that tested the security effectiveness of the SA-3000 when it was known as the Neoteris IVE. These reports were written and provided by the following companies:

1. TruSecure – Statement of Opinion Regarding the Instant Virtual Extranet, Version 3.1 June 11th 2003.
    - The report focuses on the Neoteris IVE, and it basically validates the vendor's claims of a good security posture.
2. Cryptography Research Inc. – Neoteris System Evaluation, June 16th 2002.
    - This report describes the findings of an extremely detailed security audit preformed on the Neoteris IVE by CRI. It contains a wealth of information regarding; the state of the OS used, how the device primarily functions, what could be potential security issues, and what requires improvement.
    - Using this report as a reference, I was able to validate my claims that the OS is completely stripped of commands, making it almost impossible to gain root access to the system.
3. Dan Farmer – Review of the Neoteris Instant Virtual Extranet (IVE), January 2002.
    - The famous Dan Farmer has done a great job describing his audit findings when he tested the Neoteris IVE. After physically tearing the box open and manipulating the OS, he was able to determine that SA-3000 uses a RedHat Linux Kernel, which is stripped and hardened.
    - The real importance of the Dan Farmer audit is in reference to the Apache Web daemon. Farmer explains that the SA-3000 is highly dependant upon Apache, and the security posture of the SA-3000 is predicated upon the stability and security of the web daemon.
4. METAGROUP – Delta 2327, Application Security Gateways Part 1 & 2 by David Thompson, July 3rd 2003.

- The primary focus of this report was to give the reader an understanding of ASG (Application Secure Gateways) and how they are best implemented in an environment. This report does not primarily focus on the SA-3000 or Neoteris IVE, but it does give good insight regarding the current state of this technology and the various issues/concerns.
- For one, this report verifies my claim that the SA-3000 or any other SSL VPN appliance should not be used as an edge device; rather they should be complimented with a good SPI firewall.

Other references that were used:

- US-CERT: SSLv2 Vulnerabilities: http://www.kb.cert.org/vuls/id/102795
- Linux Journal: Assessing the security of web applications: This URL provides a wealth of information in regards to best practices for implementing "cookie" security. >> http://www.linuxjournal.com/article.php?sid=3855
- The SSL Alternative by Mike Fratto, November 13th 2003 >> http://www.networkcomputing.com/showitem.jhtml?docid=1423f3
- US-CERT: OpenSSL Exploits: http://www.kb.cert.org/vuls/id/380864
- NetScreen SA Customer Support Site: http://support.neoteris.com In order to access this site, you must have a support contract with NetScreen. Located on this site are: support knowledge-base, FAQ database, and all the vendor specific manuals for their products.

2.0 Assignment 2 – Create an Audit Checklist

The properly assess the NetScreen SA-3000; the following audit checklists where created to test the identified risks mentioned in section 1.0 of this document. Each particular item listed in the checklist will contain the following information:

- Checklist Item Number = to be used for cross-referencing.
- Item Title = short and brief description of the item.
- Reference = all associated research material used for this item.
- Risk = identifies the risk and any potential consequences.
- Testing Procedure = description of the process using tools and/or commands.
- Compliance Criteria = is the system compliant?
- Objective or Subjective Test?

2.1 NetScreen audit checklist

Audit Item 1	Control Objective	Verify that command-line sessions with the SA-3000 as an attempt to gain access to the device cannot be initiated.
Reference	1. Dan Farmer's Neoteris IVE security audit; page 4, second to last paragraph. http://www.ipm.com/fileadmin/PDF/Neoteris/Farmer_Security_report.pdf 2. Cryptography Research Inc, page 15, paragraph 3.5.2 3. Personal experience and knowledge.	
Risk	If command sessions are allowed by the SA-3000, there's a possibility that a hacker could take "root" control of the system and compromise not only the device, but potentially the network itself and all associated resources behind it.	
Testing	Try using any of the following commands: Telnet, SSH, or any Unix Shell from either a command prompt or by using a GUI. Open a command prompt and type the following: **C:\telnet <ip address or hostname> or use any SSH client and attempt to connect to the device's public & private IP.**	
Compliance	Response upon attempting to connect should be **"could not open connection to the host, connection failed."**	
Objective/Subjective	Objective	

Audit Item 2	Control Objective	Verify that only specified IP's can access the SA-3000 via the web-admin console.
Reference	1. NetScreen SA-3000 Administration Manual available only on the customer website. 2. Personal experience and knowledge.	
Risk	If the administrator does not identify & configure the use of specific private IP's to ONLY have access to the web-admin console, any unauthorized user will have the ability to attempt a logon.	
Testing	Open the SA-3000 web-admin console by typing the private IP address of the device in any standard web browser: URL = https://10.5.1.2 Login in and click on the tab named "Administrators." Select the tab named "Authentication" and then "Address Restrictions."	

Compliance	Either option; “Administrators can sign in from any IP address” or “Administrators can only sign in from the following IP’s” should be selected. Specified IP’s would be specified with option 2 selected.
Objective/Subjective	Objective

Audit Item 3	Control Objective	Verify that all sessions are encrypted from the client browser to the OWA server via the Internet by means of the SA-3000.
Reference	1. Ethereal Packet Sniffing, by Angela D. Orebaugh – Syngress Publishers. 2. Personal experience and knowledge.	
Risk	Unencrypted information between the client browser and the OWA is susceptible to prying eyes on the Internet. Anyone can use a sniffing tool to capture the clear-text information and use it to their advantage. This would be a violation to Acme’s external security policy.	
Testing	Use Ethereal or any sniffing capable utility to capture packets between the client browser and the OWA server to insure that all information is in fact encrypted. Install Ethereal on your client machine and configure it capture via promiscuous interface, enable “capture” and filter by “IP” to view the results.	
Compliance	If encrypted, the results via Ethereal should display all packets are in fact using SSLv3 & HTTPS; for all 3-way TCP handshakes included.	
Objective/Subjective	Objective	

Audit Item 4	Control Objective	Verify that all authentication attempts & user session requests are being logged by the SA-3000.
Reference	1. NetScreen SA-3000 Administration Manual available only on the customer website. 2. Personal experience and knowledge.	
Risk	1. If authentication requests are not being logged, there is no conceivable way to know who’s attempting to login to the SA-3000, and verify who does & doesn’t have authorized privileges. 2. If user session requests are not being logged, there is no way to track the user’s activity, or have an audit trail of which resources are being accessed.	
Testing	Open the SA-3000 web-admin console by typing the private IP address of the device in any standard web browser: URL = https://10.5.1.2 Login in and click on the tab named “General Settings” and then “Log.” Set your logs to the highest number being 5000 and select “update.” Review the logs and look for good and then any erroneous entries.	
Compliance	1. Failed authentication attempts to the Radius Server will read “authentication failure” or “user not defined on the authentication server.” 2. Accepted authentication attempts to the Radius Server will read “authentication successful for user XYZ.” 3. Able to track the allowed user’s activity and follow an audit trail to the retrospective resources.	
Objective/Subjective	Objective	

Audit Item 5	Control Objective	Verify that only ports 80 & 443 are listening via the SA-3000.
Reference	1. Cryptography Research Inc, page 8, paragraph 3.1. 2. Verifying which ports are listening – RedHat Security Guide Ch. 5 Server Security http://www.redhat.com/docs/manuals/linux/RHL-9-Manual/security-guide/s1-server-ports.html	
Risk	Any other TCP ports that are unnecessarily open and listening on the SA-3000 are a potential security weakness, giving a hacker more opportunities to run specific attacks against non-required services.	
Testing	Use "Nmap" to scan both the public & private IP to determine what TCP services the device itself and/or the firewall is allowing to and from the SA-3000.	
Compliance	Results of an Nmap scan should display that only TCP ports 443 (SSL) and 80 (HTTP) are listening on the SA-3000 and being passed by the protecting firewall.	
Objective/Subjective	Objective	

Audit Item 6	Control Objective	Verify that the SA-3000 only accepts the SSLv3 protocol.
Reference	1. NetScreen SA-3000 Administration Manual available only on the customer website. 2. Personal experience and knowledge. 3. CERT - http://www.kb.cert.org/vuls/id/102795	
Risk	According to CERT advisories, anything other that SSLv3 is considered a security risk. There are certain exploits within the SSLv2 protocol that would allow a hacker to run arbitrary code on the targeted machine.	
Testing	Open the SA-3000 web-admin console by typing the private IP address of the device in any standard web browser: URL = https://10.5.1.2 Login in and click on the tab named "General Settings" and then "Security." Check to see if SSLv3 has been selected.	
Compliance	On the SA-3000 web-admin console, the following should be displayed and selected "Accept Only SSL V3 & TLS (maximize security)."	
Objective/Subjective	Objective	

Audit Item 7	Control Objective	Verify that the SA-3000 encrypts using Triple DES 168-bit ciphers.
Reference	Personal experience and knowledge.	
Risk	In the case of Acme Corporation's security policy, they only allow the use of 3DES 168-bit ciphers for all HTTPS connections to and from the OWA server via the SA-3000. Anything else is considered a violation of the corporate security policy.	
Testing	Using Internet Explorer as an example: Type in the URL https://extranet.acme.com and select "yes" to accept the SSL certificate. To check the established SSL browser security, from within IE go to "File, Properties" and check the security ciphers used under the section named "Connections."	
Compliance	Within "File, Properties" and under the section "Connections" the ciphers listed should state "Triple DES with 168-bit encryption (HIGH)."	
Objective/Subjective	Objective	

Audit Item 8	Control Objective	Verify that the SA-3000 is using a trusted CA certificate.
Reference	1. Cryptography Research Inc, page 4, paragraph 2.2. 2. BlackHat Top Ten Web Attacks, http://www.blackhat.com/presentations/bh-asia-02/bh-asia-02-shah.pdf 3. Personal experience and knowledge.	
Risk	If not used, there is a possibility that a hacker could initiate a server impersonation attack.	
Testing	Using Internet Explorer type in the following URL https://extranet.acme.com and wait for a "security alert" dialog box to appear. Check to see which of the three alerts has been validated or not.	
Compliance	If an SSL cert from a Trusted CA is installed and being used by the SA-3000, an alert would not be displayed by the client browser.	
Objective/Subjective	Objective	

Audit Item 9	Control Objective	Verify that the SA-3000 is not using persistent cookies for all client browsers that access OWA.
Reference	1. NetScreen SA-3000 Administration Manual available only on the customer website. 2. Personal experience and knowledge. 3. Linux Journal: http://www.linuxjournal.com/article.php?sid=3855	
Risk	Information regarding the connected session to the SA-3000 is stored in either persistent or non-persistent cookies. In the case of persistence, that cookie is stored on the local hard-drive of a PC. That persistent cookie has a certain life, based on a time-stamp. However, until it's deleted, it contains user information that could be used by a hacker to gain additional insight that would increase the security risk level.	
Testing	Open the SA-3000 web-admin console by typing the private IP address of the device in any standard web browser: URL = https://10.5.1.2 Login in and click on the tab named "Groups" and then "named Group." Select "web" and check the item called "Enable Persistent Session Cookie."	
Compliance	By default, the setting for Persistent Cookies on the SA-3000 should not be enabled. It should read "Use user's setting (disabled)."	
Objective/Subjective	Objective	

Audit Item 10	Control Objective	Verify that all cached browser information is deleted from the client upon logging off the SA-3000.
Reference	1. NetScreen SA-3000 Administration Manual available only on the customer website. 2. Secrets of Computer Espionage, Tactics and Countermeasures, by Joel McNamara – Chapter 5, page 111, Gathering Evidence, browser cached information. 3. Personal experience and knowledge.	
Risk	Any and all cached information left behind by the browser on a PC (especially a shared system, or kiosk) gives any non-Acme employee the ability to take a sneak peak at confidential information.	

Testing	1. Open the SA-3000 web-admin console by typing the private IP address of the device in any standard web browser: URL = https://10.5.1.2 Login in and click on the tab named "Groups" and then "named Group." Click on the tab "General" and then "Web." Scroll down to the section called "Enable Cache Cleaner." 2. On the client IE browser, "Tools, Internet Options, Temporary Internet Files, Settings, View Files and View Objects. 3. On the Windows system, "c:\Program Files\Neoteris."
Compliance	1. The Windows file path < C:\Documents and Settings\atg007\Local Settings\Temporary Internet Files> should not leave any trace files when the user logs-out from the SA-3000. 2. The Windows file path < C:\WINDOWS\Downloaded Program Files> should contain a file called "NeoterisSetupControl." 3. The Windows file path <c:\Program Files\Neoteris> should contain a file called "dsCacheCleaner."
Objective/Subjective	Objective

Audit Item 11	Control Objective	Verify that hostname encoding is turned-on to protect the OWA server name.
Reference	1. NetScreen SA-3000 Administration Manual available only on the customer website. 2. Personal experience and knowledge. 3. RFC 1738 - http://www.faqs.org/rfcs/rfc1738.html	
Risk	Exposing the hostname in the URL path provides more than enough information about internal server names. This information should be kept private at all times.	
Testing	1. Authenticate to the SA-3000, your automatically redirected to the OWA server. Check the URL path in the status bar within your browser. 2. Open the SA-3000 web-admin console by typing the private IP address of the device in any standard web browser: URL = https://10.5.1.2 Login in and click on the tab named "Groups" and then "named Group." Click on the tab "General" and then "Web." Check the option called "Enable Encoded Hostname."	
Compliance	1. The URL path displayed by a standard browser should use encoding to mask the real server name. 2. The option "Enable Encoded Hostname" should be set to "enabled."	
Objective/Subjective	Objective	

Audit Item 12	Control Objective	Verify that Radius is configured to authenticate users to the SA-3000.
Reference	1. NetScreen SA-3000 Administration Manual available only on the customer website. 2. Personal experience and knowledge.	
Risk	Access to OWA will fail, thus remote users will not have the ability to check mail.	
Testing	Open the SA-3000 web-admin console by typing the private IP address of the device in any standard web browser: URL = https://10.5.1.2 Login in and click on the tab named "Authentication Servers" and check the <enabled or disabled status>. Then click on the assigned server name that represents the Radius instance and check the configuration parameters. Check the "group-authentication" parameters for an assigned "group" matched to the authentication instance.	

Compliance	The SA-3000 web-admin console should display the appropriate configuration settings for the Radius primary & secondary servers. Should include the following information: IP addresses, port 1645, Radius shared-secret, Group Matching, and server is <enabled>.
Objective/Subjective	Objective

Audit Item 13	Control Objective	Verify that the "web-admin" console is in fact using HTTPS.
Reference	1. NetScreen SA-3000 Administration Manual available only on the customer website. 2. Personal experience and knowledge.	
Risk	If the web-admin console was not using HTTPS to encrypt the information in transit, the configuration information could be potentially intercepted.	
Testing	Open the SA-3000 web-admin console by typing the private IP address of the device in any standard web browser: URL = https://10.5.1.2 To check the established SSL browser security, from within IE go to "File, Properties" and check "connections" & "address URL."	
Compliance	The information should read: 1. Connections = SSL 2. Address URL = https in the beginning of the URL path.	
Objective/Subjective	Objective	

Audit Item 14	Control Objective	Verify that password protection for the SA-3000 console is enabled.
Reference	1. NetScreen SA-3000 Administration Manual available only on the customer website. 2. Personal experience and knowledge.	
Risk	If the console is not password protected, and unauthorized person who has physical access to the SA-3000 could compromise certain functions of the device and render it useless.	
Testing	Using a terminal emulator, open a 9600 baud connection from a remote PC or device that can make use of a serial connector cable. Once the session has been initiated, click on any key to start the console.	
Compliance	The system should automatically prompt you for a admin username and password.	
Objective/Subjective	Objective	

Audit Item 15	Control Objective	Verify that the SA-3000 has the latest OS build level and all associated security patches per vendor recommendations.
Reference	1. NetScreen SA-3000 Administration Manual available only on the customer website. 2. NetScreen customer support site, security update information centre. 3. Personal experience and knowledge.	
Risk	Since the time of it's inception to the tech market space, the SA-3000 has had some exploits based on the fact that it runs Apache, OpenSSL, and relies on a Linux kernel. To keep the device within good operational security practices, not using the current security patch revisions could leave the SA-3000 exposed to these vulnerabilities.	

Testing	Open the SA-3000 web-admin console by typing the private IP address of the device in any standard web browser: URL = https://10.5.1.2 1. The opening page “System Settings,” “General Settings.” “System Software Package Version.” 2. NetScreen customer support site, posts all the latest security patches for all its customers.
Compliance	The latest security build for the SA-3000 should read <3.3.1-S1 Release (Build 5651)>
Objective/Subjective	Objective

3. Assignment 3 – Conduct the Audit

The following section will expand upon ten (10) of the most critical audit checks and will include the results and findings of each tested risk.

3.1 Actual Audit of NetScreen Secure Access SA-3000

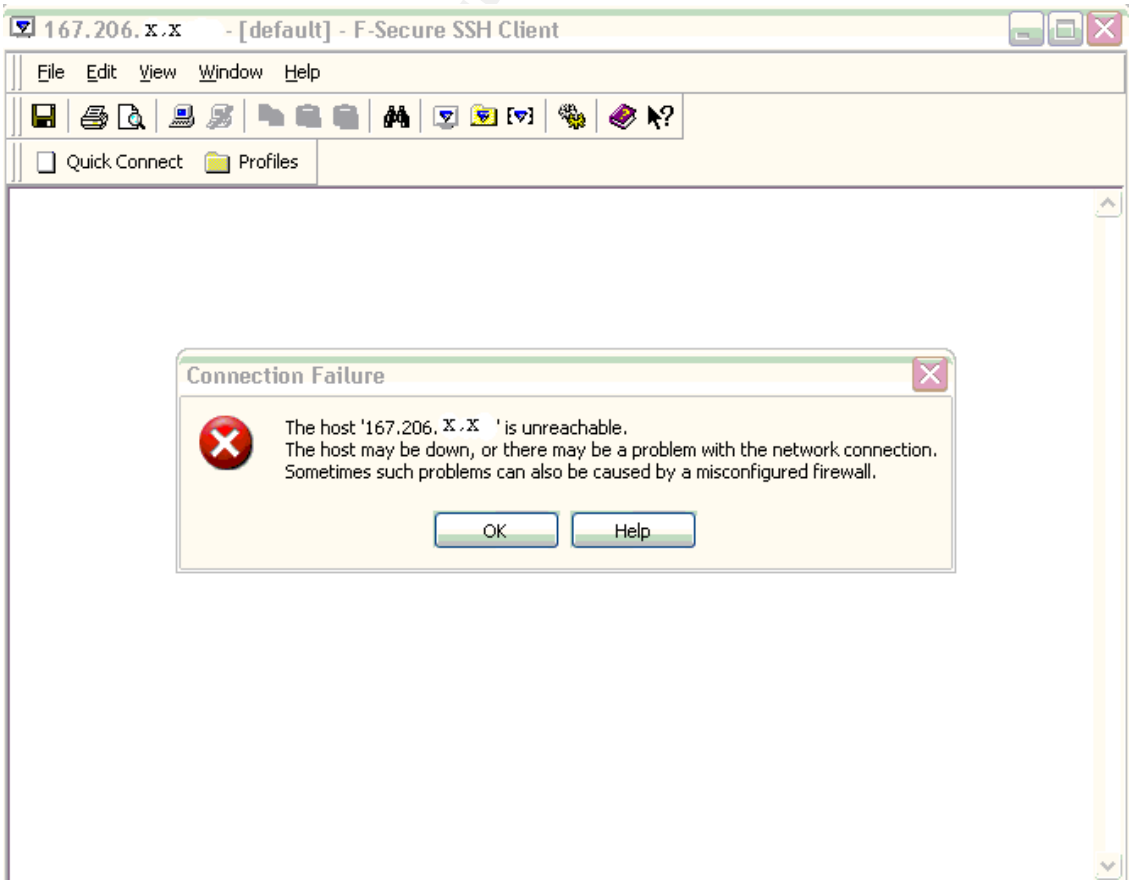
Audit Item 1	Objective	Verify that command-line sessions with the SA-3000 as an attempt to gain access to the device cannot be initiated.	PASS

Test

Used the following: Telnet and SSH to the SA-3000's internal & external IP address.

1. Telnet from a Windows XP Command Line:

2. SSH to the SA-3000 using F-Secure SSH client:



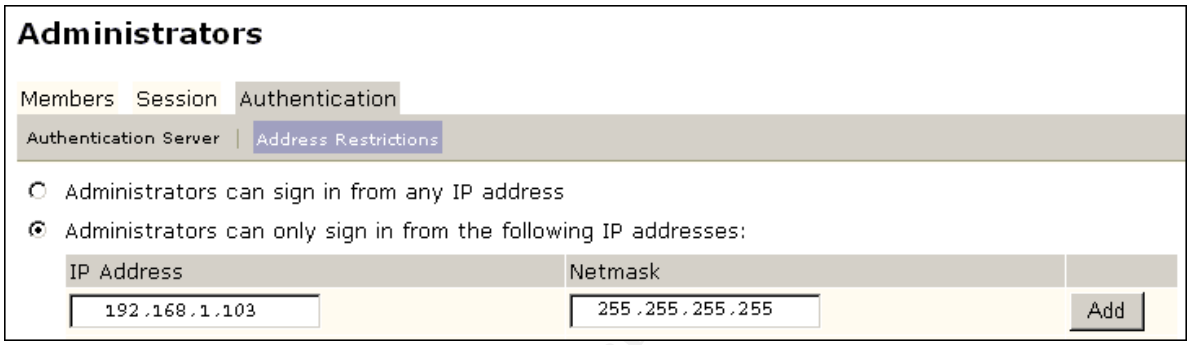
Audit Item 2	Objective	Verify that only specified IP's can access the SA-3000 via the web-admin console.	PASS

Test

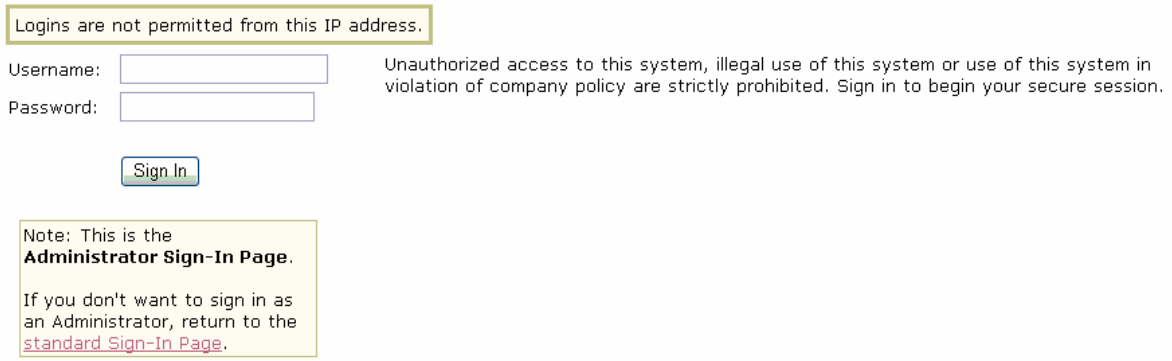
Open the SA-3000 web-admin console by typing the private IP address of the device in any standard web browser: URL = https://10.5.1.2

Login in and click on the tab named "Administrators." Select the tab named "Authentication" and then "Address Restrictions."

1. **SA-3000 Web-Admin Console Settings:**



2. **Testing Access From a Non-Listed IP address:**

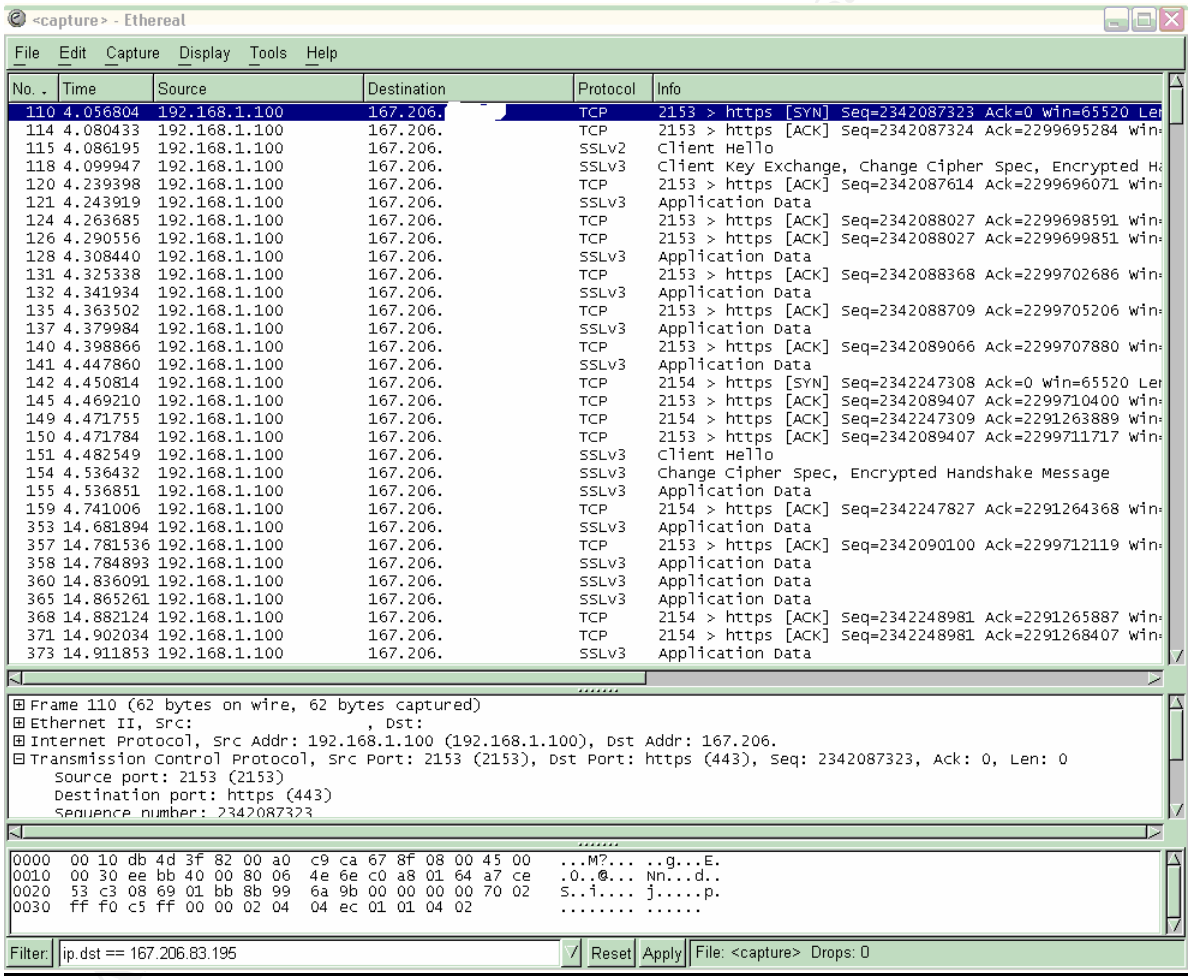


Audit Item 3	Objective	Verify that all sessions are encrypted from the client browser to the OWA server via the Internet by means of the SA-3000.	PASS

Test

Using Ethereal I was able to capture packets between the client browser and communication to the OWA server, to insure that all information is in fact encrypted. The capture is filtered by “IP” to view required the results.

Ethereal Capture between an Internet client and the SA-3000:



Audit Item 4	Objective	Verify that all authentication attempts & user session requests are being logged by the SA-3000.	PASS
Test	Open the SA-3000 web-admin console by typing the private IP address of the device in any standard web browser: URL = https://10.5.1.2 Login in and click on the tab named “General Settings” and then “Log.” **Radius Authentication logged:** 2004/03/15 23:03:30 - ( ) - Login succeeded for user (24.189.). 2004/03/15 23:03:30 - System - / from IP 24.189. authenticated successfully using Radius authentication. 2004/03/15 23:03:30 - System - Get fixed IVE group for user using authentication server **User Sessions logged:** 2004/03/15 23:03:43 - - WebRequest ok : Host: webmail.frx.com, Request: GET /exchange/Navbar/inbox.gif HTTP/1.1 2004/03/15 23:03:43 - - WebRequest ok : Host: webmail.frx.com, Request: GET /exchange/inbox/main_fr.asp?view=1&store=0&obj=&acs= HTTP/1.1 2004/03/15 23:03:43 - - WebRequest ok : Host: webmail.frx.com, Request: GET /exchange/Navbar/nbInbox.asp HTTP/1.1 2004/03/15 23:03:42 - - WebRequest ok : Host: webmail.frx.com, Request: GET /exchange/root.asp HTTP/1.1 2004/03/15 23:03:41 - - WebRequest ok : Host: webmail.frx.com, Request: GET /exchange/LogonFrm.asp?isnewwindow=0&mailbox=alexander.stamatiou H 2004/03/15 23:03:34 - - WebRequest ok : Host: webmail.frx.com, Request: GET /exchange/images/right_top2.jpg HTTP/1.1 2004/03/15 23:03:34 - - WebRequest ok : Host: webmail.frx.com, Request: GET /exchange/images/go_button.gif HTTP/1.1 2004/03/15 23:03:34 - - WebRequest ok : Host: seal.verisign.com, Request: GET /flash/seal_130x88.swf?fp=WEBMAIL. .COM HTTP/1.1 2004/03/15 23:03:33 - - WebRequest ok : Host: seal.verisign.com, Request: GET /getseal?host_name=webmail. .com&size=L&use_flash=YES&use_transpa 2004/03/15 23:03:33 - - WebRequest ok : Host: webmail.frx.com, Request: GET /exchange/images/logofrx.jpg HTTP/1.1 2004/03/15 23:03:32 - - WebRequest ok : Host: webmail.frx.com, Request: GET /exchange/logon.asp HTTP/1.1 2004/03/15 23:03:32 - - WebRequest ok : Host: email.frx.com, Request: GET / HTTP/1.1		

Audit Item 5	Objective	Verify that only ports 80 & 443 are listening via the SA-3000.	PASS

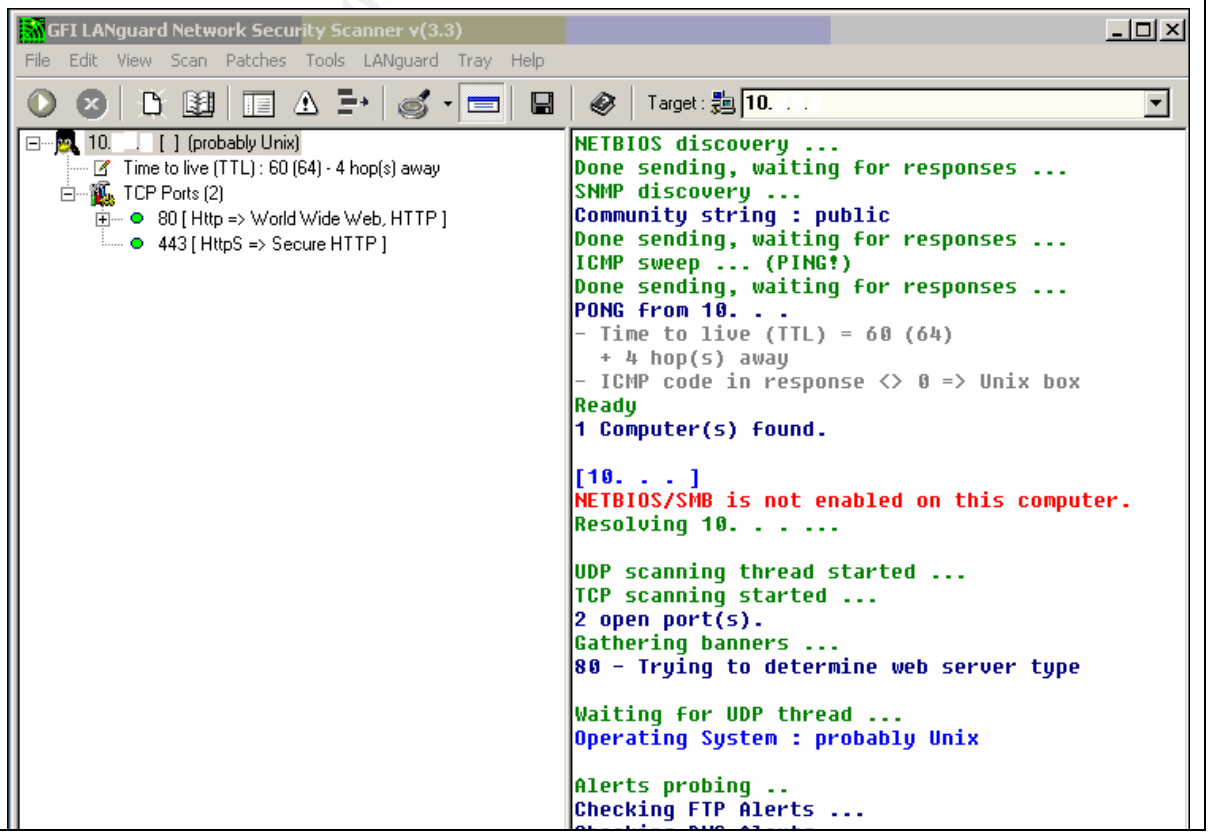
Test

Used “Nmap” and “GFI-LAN Guard” security scanners to sweep both the public & private IP of the SA-3000 to determine what TCP services the device itself and/or the firewall is allowing to and from.

Scan for open ports to verify for all TCP listeners, making sure only 80 and 443 exist:

```
Starting nmap V. 3.00 ( www.insecure.org/nmap )
Interesting ports on  (10.[illegible]):
(The 1584 ports scanned but not shown below are in state: filtered)
Port       State       Service
25/tcp     closed      smtp
80/tcp     open        http
443/tcp    open        https
465/tcp    closed      smtps
993/tcp    closed      imaps
995/tcp    closed      pop3s
6000/tcp   closed      X11
6001/tcp   closed      X11:1
6002/tcp   closed      X11:2
6003/tcp   closed      X11:3
```

```
6004/tcp   closed      X11:4
6005/tcp   closed      X11:5
6006/tcp   closed      X11:6
6007/tcp   closed      X11:7
6008/tcp   closed      X11:8
6009/tcp   closed      X11:9
6050/tcp   closed      arcserve
No exact OS matches for host (If you know what OS is ru
nning on it, see http://www.insecure.org/cgi-bin/nmap-submit.cgi).
TCP/IP fingerprint:
SInfo(V=3.00%P=i686-pc-windows-windows%D=3/16%Time=4056913E%D=80%C=25)
TSeq(Class=RI%gcd=1%SI=3E4CC5%IPID=Z%TS=100HZ)
TSeq(Class=RI%gcd=1%SI=3E471C%IPID=Z%TS=100HZ)
TSeq(Class=RI%gcd=1%SI=3E4610%IPID=Z%TS=100HZ)
T1(Resp=Y%DF=Y%W=16A0%ACK=S++%Flags=AS%Ops=MNNTNW)
```

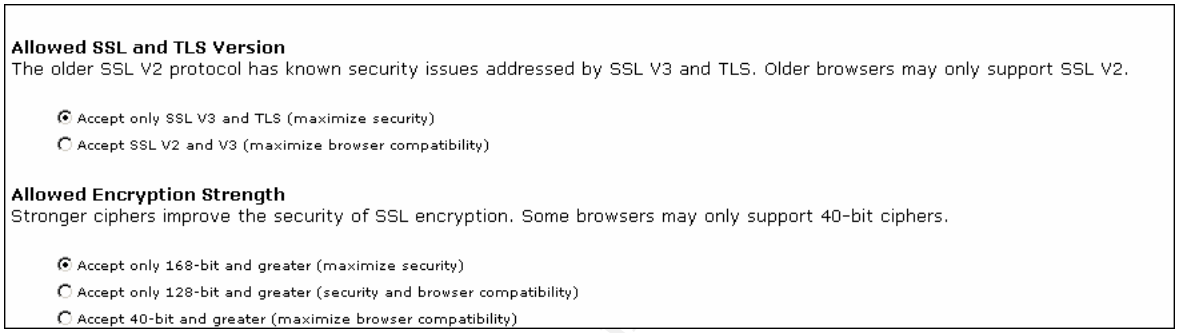


Audit Item 6	Objective	Verify that the SA-3000 only accepts the SSLv3 protocol.	PASS

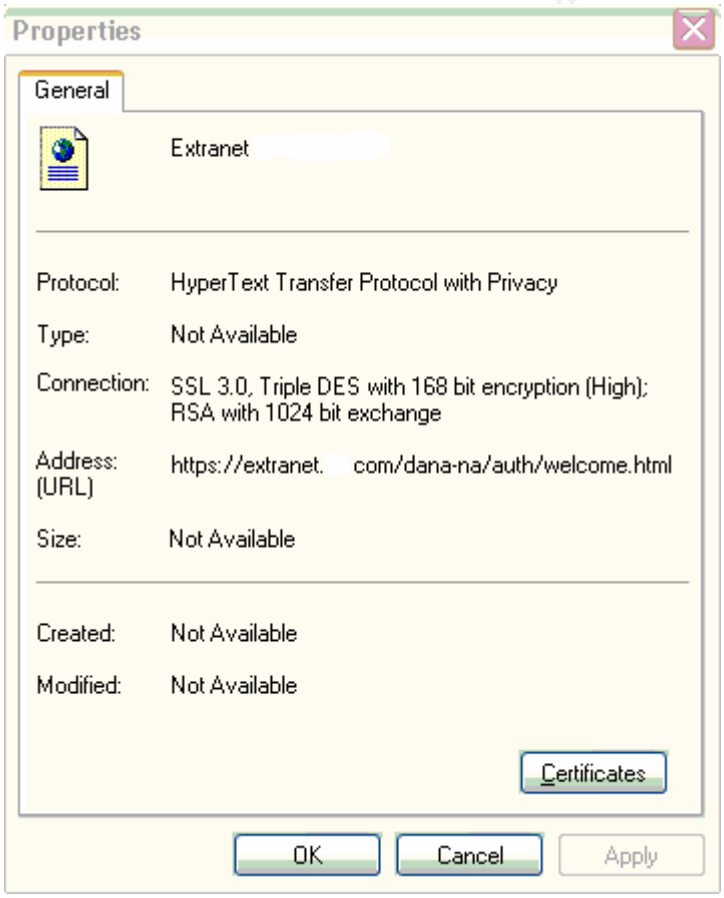
Test

Open the SA-3000 web-admin console by typing the private IP address of the device in any standard web browser: URL = https://10.5.1.2 Login in and click on the tab named “General Settings” and then “Security.” Check to see if SSLv3 has been selected.

SSLv3 Selected as only protocol allowed:



SSLv3 verified via client connection with a supports connections for both SSLv2 & 3:

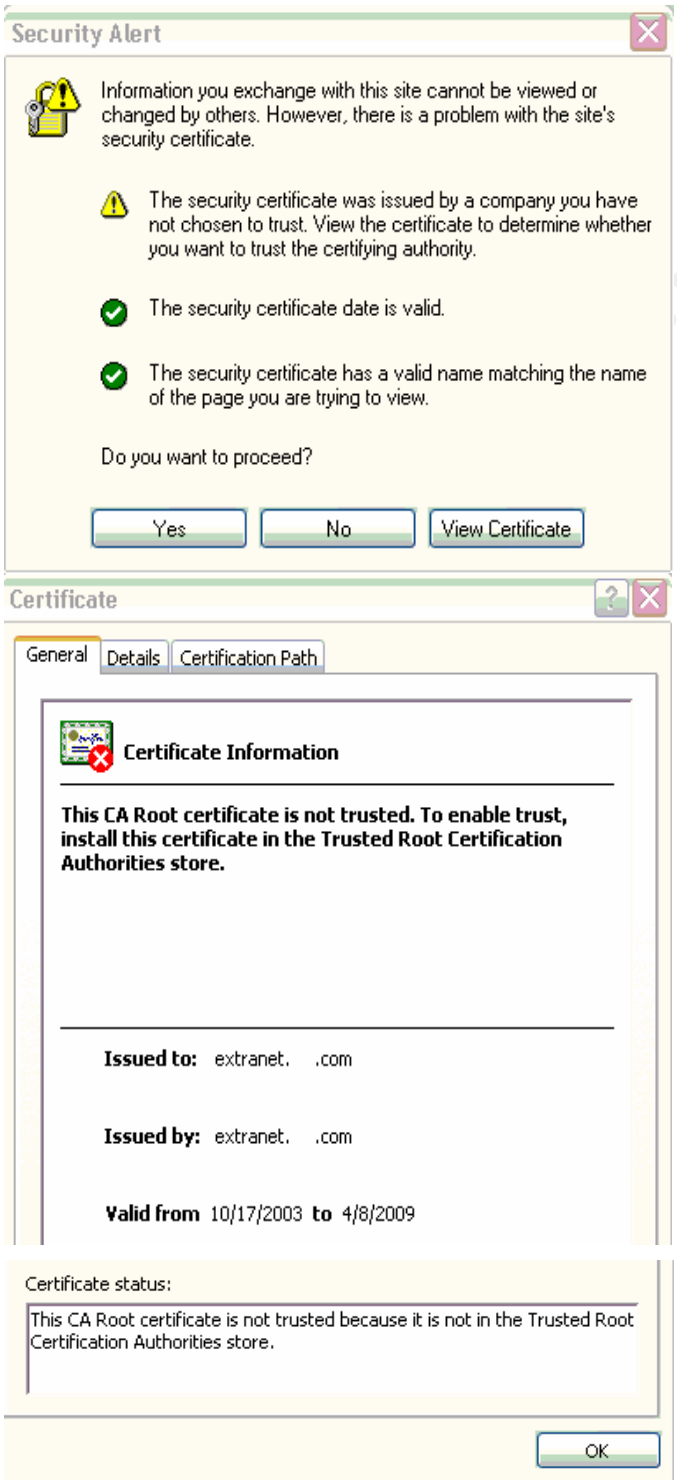


Audit Item 8	Objective	Verify that the SA-3000 is using a trusted CA certificate.	FAIL

Test

Using Internet Explorer type in the following URL https://extranet.acme.com and wait for a "security alert" dialog box to appear. Check to see which of the three alerts has been validated or not.

Validate that a CA cert is being issued by the SA-3000:

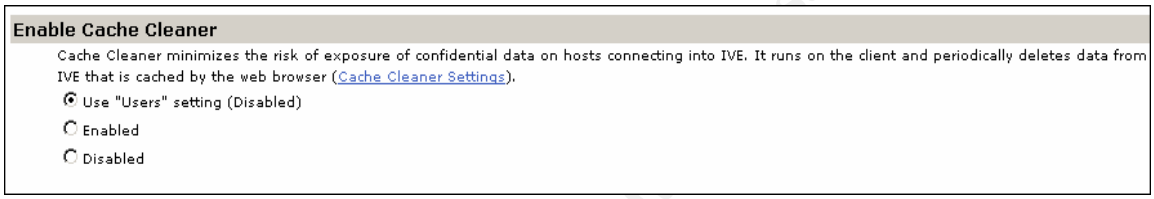


Test 8 (Continued)	**Validate that a CA cert is configured on the SA-3000:** 

Audit Item 10	Objective	Verify that all cached browser information is deleted from the client upon logging off the SA-3000.	FAIL
Test			

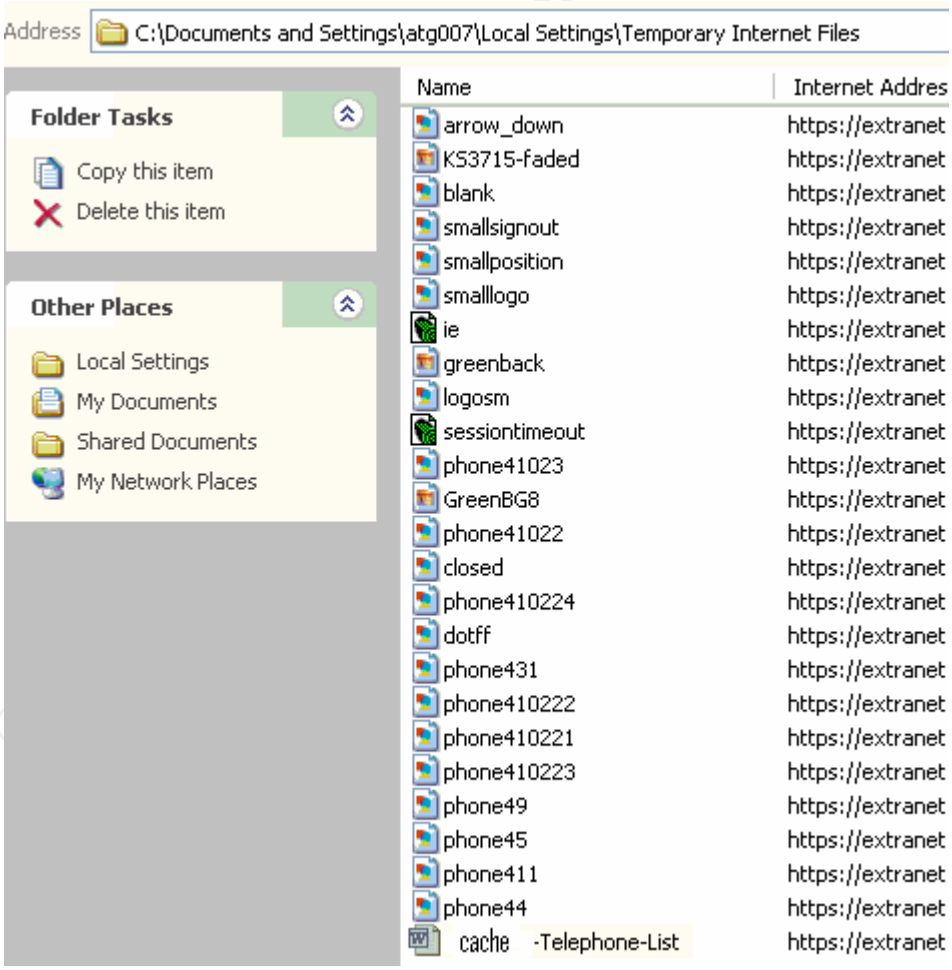
1. Open the SA-3000 web-admin console by typing the private IP address of the device in any standard web browser: URL = https://10.5.1.2 Login in and click on the tab named “Groups” and then “named Group.” Click on the tab “General” and then “Web.” Scroll down to the section called “Enable Cache Cleaner.”

Cache Cleaner Configuration on SA-3000 (disabled):

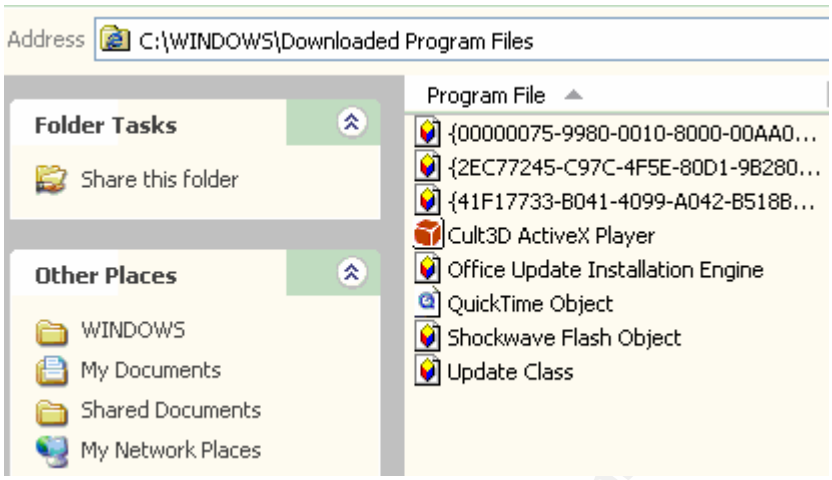
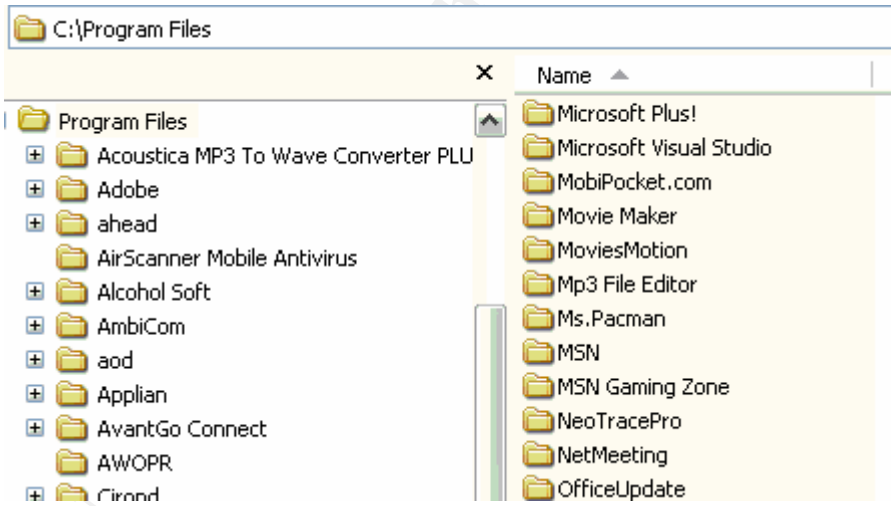


2. On the client IE browser, “Tools, Internet Options, Temporary Internet Files, Settings, View Files and View Objects.

Cached Files in IE Temp Directory (cached file exists after logoff).



<< **Cached File**

Test 10 (Continued)	**IE Objects (NeoterisSetupControl does not exist – cache control not present):**  3. On the Windows system, "c:\Program Files\Neoteris." **Neoteris <dsCacheCleaner.exe> not present – cache removal utility not installed:** 

Audit Item 14	Objective	Verify that password protection for the SA-3000 console is enabled.	PASS

Testing

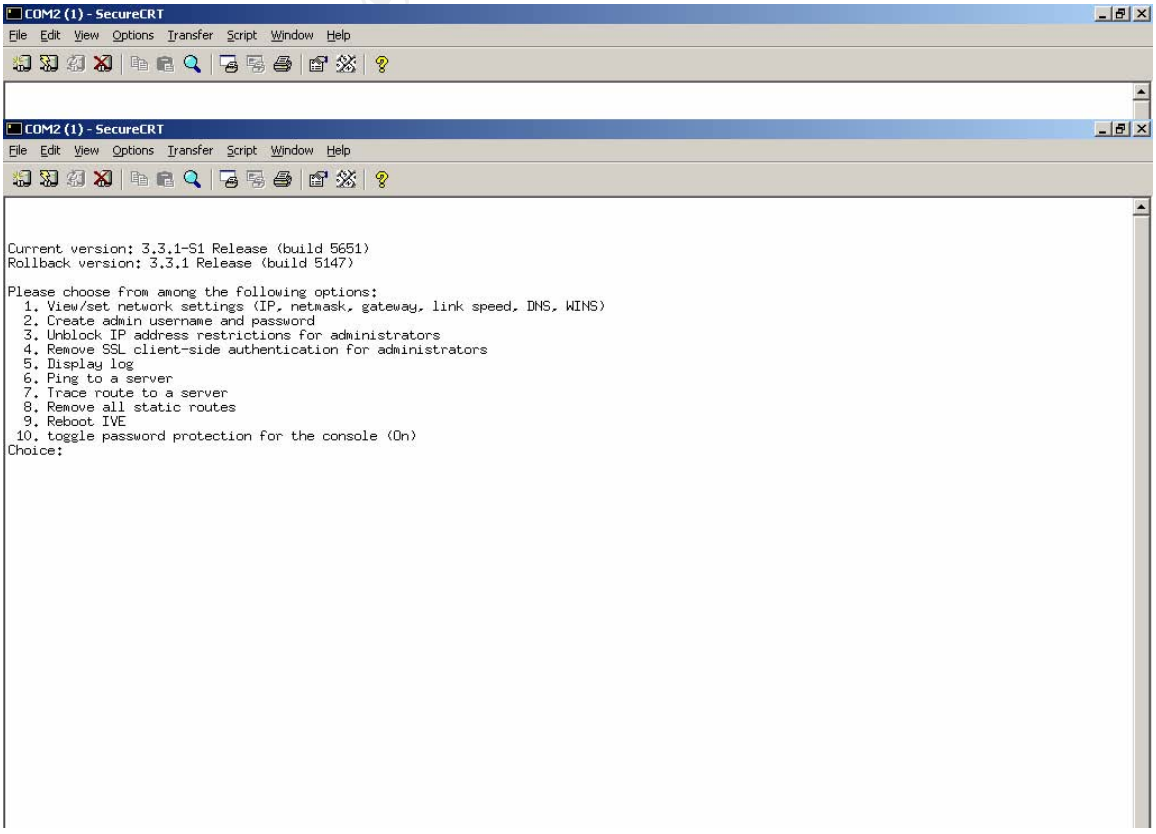
Using a terminal emulator, I opened a 9600 baud connection from a remote PC.

SA-3000 Console (protected):

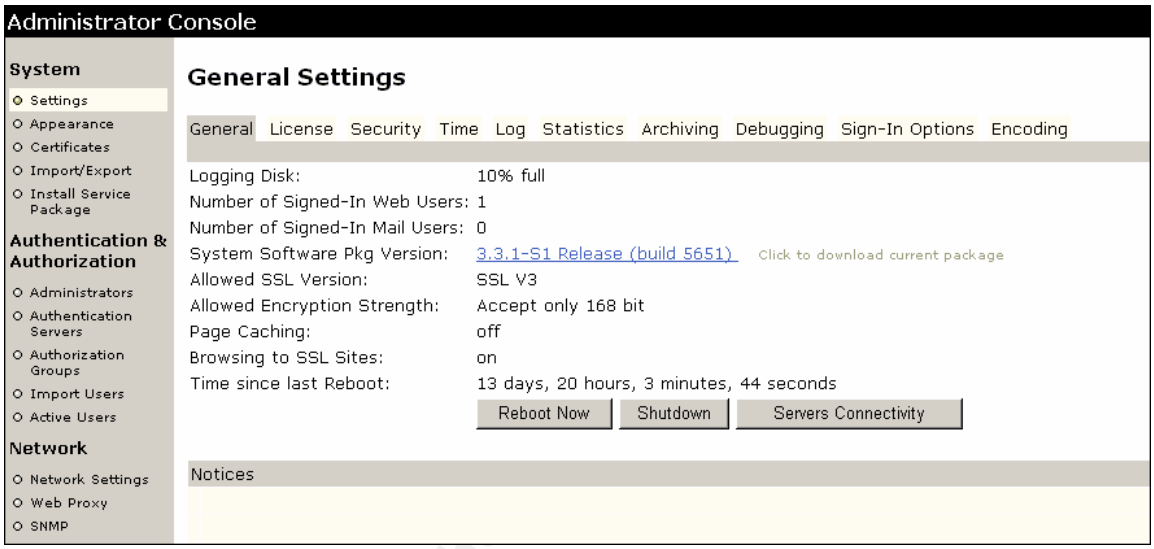
```
Welcome to the Neoteris Serial Console!

Please input an administrator username and password.
Admin username:
```

Toggle Console Password Control On/Off:



Audit Item 15	Objective	Verify that the SA-3000 has the latest OS build level and all associated security patches per vendor recommendations.	PASS
Test	Open the SA-3000 web-admin console by typing the private IP address of the device in any standard web browser: URL = https://10.5.1.2 1. Web-Admin initial page “System Settings,” “General Settings.” “System Software Package Version.” **Latest Software Build (up-to-date with vendor’s recommendation:**		



3.2 Residual Risk?

As SANS clearly states, “residual risk = exposure – controls.” Knowing this, it is safe to say that the exposure of the SA-3000 is on the most part pretty low. As for controls, there are a few additions that should have been enforced, as to increase the overall security posture evenmore. In the everyday world of information security, there will always be risks. It’s important for Acme Corporation to determine what level of risk they are willing to assign the SA-3000? Meaning, if the device is compromised – what level of risk is deemed acceptable to the corporation. The best way to do that, is to base the “risk” level on the particular business system that the SA-3000 secures & supports. Also, should the SA-3000 be compromised, what other systems are potentially vulnerable. These are all important factors that need to taken into consideration in hopes of calculating an acceptable risk factor.

As for the SA-3000, its current configuration and deployement boasts a better than average level of exposure. However, the controls could be much better. During the actual audit, the SA-3000 failed against two crucial checks. If these controls were to be implemented, the overall security posture for the SA-3000 would increase dramatically. Thus, with the “controls” in the positive and the “exposure” being low – we can manage to reduce the risk. To accomplish this task, all that would be required is man-hours.

3.3 Is the System Auditable?

On the most part, the SA-3000 was actually quite fun to audit and not a very difficult task. Since the SA-3000 is an appliance, most of the core functionality of the operating system has been stripped to only include what it needs. Taking this into consideration, it was easier to develop a good checklist to test the core mechanics that most hackers would look to find inherent weaknesses. The trick is to concentrate on the way the product works. Thus, as a security auditor it was more challenging because I was required to base the foundation of my audit on practical experience. The other challenge of this audit was to develop a good set of “controls.” Since all Application Security Gateways are relatively new to the market space, it’s quite hard to find any developed audit checklists already in existence. As a result, I had to start from scratch and come up with my own methodologies for the NetScreen SA-3000.

4. Assignment 4 – Audit Report

4.1 Executive summary

On the most part, I found the NetScreen SA-3000 to be a very secure product. It seems to better secure the OWA infrastructure than having just a standalone system on a public DMZ. Even if the OWA server was to have an SSL certificate installed, it still wouldn't provide the same level of security as the SA-3000. The basic principles of using "true application awareness" and "proxy" capabilities; better enhances the security posture of hosting a web-mail system on the Internet.

On the most part, the SA-3000 does exactly what the vendor claims. It secures all the connections using standard SSL protocols, does not require configuration changes on the client, and it effectively logs everything that passes through it. The logging capabilities are quite impressive, giving Acme Corporation the advantage of monitoring every authenticated request and all user session activity. In the long run, the logs capabilities are a very effective tool against any violations to the security policy.

The only real issues that I had with the SA-3000, is its lack of ability to control caching functions on the client. For the sake of protecting intellectual property, I would like to have seen a little more flexibility with cache-controls. The Cache-Cleaner function that NetScreen offers has limitations; based on what rights a user has on a desktop. With that, it is sometimes impossible to make it work. Thus, a shared computer can contain cached information once a user was to logoff of the SA-3000. That would especially apply to kiosks.

4.2 Audit findings/Risk/Recommendations/Costs/Compensating controls

Upon completion of the audit, the SA-3000 passed all security checks with the exception of two. Of the two that it missed; one can be easily fixed and the other is yet an issue that the vendor is well aware of. Here are the highlights of this audit, based on my findings:

- The SSL cert is a self-signed certificate that is automatically generated during the initial install of the SA-3000. From a security standpoint, it is fine to keep it this way. However, using a trusted certificate from a CA improves upon security. By using a trusted CA cert, you will reduce your risk as a result of impersonation attacks not being possible.
- The Cache-Cleaner option called "dsCacheCleaner.exe" only works when a user has "admin" or "power-user" rights on the client machine. Upon establishing a session with the SA-3000, an ActiveX control is temporarily installed on the client machine. This ActiveX control is state-aware and keeps track of all cached information that is placed within temporary directories. Once the user logs off, the dsCacheCleaner will remove all the cached information. It's hard to make a recommendation for this issue, as the vendor is aware that this only works with required privileges.
- Access to the web-admin is secure and extremely easy to operate. However, the web-admin console is accessible from anywhere. That means that it is

imperative to configure TCP wrappers and specify which IP addresses are allowed and not allowed. As a recommendation, the vendor should add more features to this option and allow for 2-factor authentication as a means to better secure the process.

- The addition of policies would make sense as well. This way it is possible to create different roles to the management interface, making harder to gain access to all controls.
- Authentication for administrative control is limited to a "local" database. Recommendation is that the password is changed frequently.
- Some of default features and settings should all be set to the highest security settings upon initial configuration.
- Open policies for access to resources should be "closed" and not "open."
- Firewall configurations should only allow "specific" access controls to resources. The vendor suggests an "any – any" rule from the SA-3000 to anything internally. I would not recommend this, its more secure to define specific rules on the firewall.

5 References

1. TruSecure – Statement of Opinion Regarding the Instant Virtual Extranet, Version 3.1 June 11th 2003.
2. Cryptography Research Inc. – Neoteris System Evaluation, June 16th 2002.
3. Dan Farmer – Review of the Neoteris Instant Virtual Extranet (IVE), January 2002.
4. METAGROUP – Delta 2327, Application Security Gateways Part 1 & 2 by David Thompson, July 3rd 2003.
5. US-CERT: SSLv2 Vulnerabilities: http://www.kb.cert.org/vuls/id/102795
6. Linux Journal: Assessing the security of web applications: This URL provides a wealth of information in regards to best practices for implementing "cookie" security. >> http://www.linuxjournal.com/article.php?sid=3855
7. The SSL Alternative by Mike Fratto, November 13th 2003 >> http://www.networkcomputing.com/showitem.jhtml?docid=1423f3
8. US-CERT: OpenSSL Exploits: http://www.kb.cert.org/vuls/id/380864
9. NetScreen SA Customer Support Site: http://support.neoteris.com In order to access this site, you must have a support contract with NetScreen. Located on this site are: support knowledge-base, FAQ database, and all the vendor specific manuals for their products.
10. RFC 1738 - http://www.faqs.org/rfcs/rfc1738.html
11. Secrets of Computer Espionage, Tactics and Countermeasures, by Joel McNamara – Chapter 5, page 111, Gathering Evidence, browser cached information.

12. Verifying which ports are listening – RedHat Security Guide Ch. 5 Server Security http://www.redhat.com/docs/manuals/linux/RHL-9-Manual/security-guide/s1-server-ports.html
13. CERT - http://www.kb.cert.org/vuls/id/102795
14. BlackHat Top Ten Web Attacks, http://www.blackhat.com/presentations/bh-asia-02/bh-asia-02-shah.pdf