



# Global Information Assurance Certification Paper

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# Small Business IT Auditing

*A Practical Examination Submitted in Partial Requirement for the Global Information Assurance Certification (GIAC) program for GIAC Systems and Network Auditor (GSNA) certification v1.2.*

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# Part I: Small Business IT Auditing with OS/Machine Variations

## ***A. Motivation and Background***

Current practice in enterprise, or firm-wide systems audit, measurement, and control is well covered in theory. Checklists abound: there are well-defined overall practices defined by CERT and ISACA, two organizations devoted to IT and systems audit practices. An example of analytic practice can be seen in [Marchany]. However most examples suffer from being too costly for most businesses, or too device-specific.

For measurement of individual assets there are numerous sources, including two specific auditing rulers available from the Center for Internet Security [CIS] (as of December, 2001), with several others in development. For general measurement, one must combine three approaches: 1) apply the principles implemented by the CIS rulers, based on OS and appliance-specific knowledge, 2) use developer or manufacturer references, and 3) supplement this measurement with more general checklist methods such as top-ten and top-twenty vulnerability scanning.

Every actual IT department and real world CIO or CEO might reasonably complain that their own situation is not adequately covered, either because of unique organizational features, or because their technology is not well documented. This essay should serve a number of purposes in both areas, as well as providing guidance for a real world small business in need of a systems security measurement benchmark.

## ***B. Proposed Improvements in Measurement and Practice***

While the two largest populations of vulnerable systems may have been covered by the latest CIS measurement techniques (Solaris and Windows 2000), there are many other popular systems and appliances attached to networks. It seems that until Windows/NT, Windows/XP, RedHat and SuSe Linux, Mac/System X, by way of systems have rulers, and until the various Cisco routers, Linksys home broadband routers, and assorted modems, Layer 4 switches, top layers, and other popular network appliances have rulers, the majority of most companies' networks will not be measurable. That does not even take into account wireless technology.

The methodology suggested by [Marchany] and others may require excessive amounts of valuable meeting time. These procedures rank and measure assets' value, risks to which they are exposed, and controls to mitigate them in such a way to focus attention on the most valuable and risky assets, and the most valuable controls. This excessive time requirement in turn can damage the credibility of the ongoing auditing process in an organization. Methodology proposed by [CERT], the Survivable Network Analysis method, was deemed to be overkill for a small business situation with few services offered and few network assets.

There are five proposed improvements to measurement and practice in this essay: 1) A time-saving, robust methodology for ranking and analyzing assets, risks, and controls, 2) a Linux (RedHat 7.1) auditing procedure based on [Laude], and on the [CIS] Solaris benchmark, 3) a Windows 98 auditing procedure based on the [CIS] Windows 2000 benchmark documentation, 4) a Linksys home router auditing procedure based on manufacturer and other documentation, and 5) a general web application auditing procedure based on [Rhoades].

There will be not one, but several proposed improvements here simply because the author needs a real world example that applies to his own firm's IT assets, and like all other CIOs and CEOs, he faces unique organization and technology features that must be accommodated. Each improvement need not be final and authoritative, since several are made. In addition, some candid feedback from the executive audience, and a review

of remedial actions taken and the rationale actually applied should be interesting and helpful to real world IT audit personnel.

### ***C. Listing IT Assets and Risks***

To explain the ranking methodology it is useful to provide a concrete framework by actually listing some example IT assets to which it will be applied. This list will also be used in Part II, to do the actual audit. This is based loosely on the CoBIT model of [ISACA], but simplified, without Key Goal or Performance indicators. The approach is to list actual assets, and the system or component by which they might be exposed to risks.

#### **1. Strategic, or Research and Development Data**

<b>Asset</b>	<b>Location</b>	<b>Potential Harm</b>
Product development code, project #1	System #1	Destruction, Disclosure, and/or Modification
Service Contracts with client-specific charges and fees	System #2	Disclosure to other clients
Email records with strategy and shareholder discussions	System #1, and remote	Disclosure of strategy, internal info, Forgery
Web site HTML and CGI code/objects.	Remote	Destruction and/or Modification

#### **2. Network and Systems Data**

<b>Asset</b>	<b>Location</b>	<b>Potential Harm</b>
PKI elements such as public keys, signatures from other sources	System #1	Modification, Forgery
Private keys: email, integrity-check, Secure Shell, other	System #1	Disclosure, Forgery
Server system logs, individual system logs	System #1	Destruction, and/or Modification
File system integrity databases	System #1	Destruction, and/or Modification
Password and related files with user information	System #1, System #2	Disclosure, Modification, Forgery
Device configuration, ACL's and administrative passwords/backdoors	System #1, System #3	Disclosure, Forgery

#### **3. Private Client or Partner Data**

<b>Asset</b>	<b>Location</b>	<b>Potential Harm</b>
Legal Disclosure Agreements with clients	System #2	Disclosure
Reports for client audits, forensic work, network design, and policy	System #2	Disclosure
Personal information from client, mailing, and customer lists	System #2	Disclosure

#### 4. Public Appearance, Storefront, or Reputation: Goodwill

Asset	Location	Potential Harm
Web site appearance – proxy for perceived quality of service	Remote (the web server)	Enterprise Reputation
Product vulnerability or quality	System #1	Product Reputation
Investor relations: perceived core competency	Remote (the web server)	Enterprise Reputation

#### 5. Service Level Obligations

Asset	Location	Potential Harm
Prepaid contractual services owed	Requires system #1	Breach of Contract Liability
Retainer service agreements	Requires system #1	Breach of Contract Liability

#### 6. Personnel Security and Goodwill

Asset	Location	Potential Harm
Personnel private records	System #2	Disclosure
Key or essential IT personnel	Home Office	Death, Incapacitation, Personnel Loss
Creditworthiness: payroll/payables cash-flow coverage	Banking/accounts procedures	Enterprise Reputation
Inside IT personnel loyalty	Home Office	Defection, Disgruntlement

#### 7. IT Physical Plant and Equipment

Asset	Location/ID	Potential Harm
Gateway/firewall routers and top layers	ID: System #3	Replacement and/or reconfiguration
DMZ hosts, dedicated firewalls – including shared resources	System #1	Replacement and/or reconfiguration
Server hosts – including shared resources	Remote	Replacement, recovery, and/or reconfiguration
Desktop PCs: x86/Linux	ID: System #1	Replacement, recovery, and/or reconfiguration
Laptops: x86/Windows	ID: System #2	Replacement, recovery, and/or reconfiguration
Office supplies, electronics	Home Office	Replacement
UPS and generator/backup power supply	Home Office	Replacement

## 8. Enumerating Risks

Risks, Potential Harm	Description	Damage to Asset
Disclosure – see Compromise	Information is made freely visible to any interested parties	Fraction
Destruction – see Compromise	Data destruction without backup of most recent and significant changes	Total
Modification – see Compromise	Possible Trojan Horse implant or other malicious unintended change to product/key	Fraction
Forgery – see Exploits, Compromise	Identity can be successfully misrepresented	Marginal
Enterprise Reputation	Unable to do business effectively	Fraction
Product Reputation – see Modification	Unable to sell product	Fraction
Contractual Liability	Operations disrupted: Loss/refund of services/monetary damages	Total
Death, Incapacitation, Personnel Loss*	Loss of expertise, reputation	Fraction
Defection, Disgruntlement	Intentional harm using systems expertise	Total
Systems Surveillance	Network vulnerabilities are disclosed	Marginal
Systems Exploits*, Denial of Service	One or more successful intrusion attempts	Fraction
Systems Compromise*	Root access and root-kit, owned by intruder	Total
Power Outage, Connectivity Outage	Basic infrastructure fails temporarily	Total
Civil or Natural Catastrophe	Go home and protect your family	Total

\* Systems exploits imply possible disclosure of any data accessible to the user id that was used. Systems compromise implies disclosure of all data accessible to the system. Personnel loss also might be considered to be enterprise reputation, effectively.

There are three systems, one physical location (the home office), banking and accounting procedures, and a remote network as locations, or possible risk vectors to the list of assets above. The asset-risk matrix will list six routes through which the firm's IT assets are exposed to risk: Systems #1 through #3, the physical premises (office), financial procedures, and the remote network (which runs the company web application and handles some email).

Risk\Asset Set	System#1	System#2	System#3	Office	Finance	Remote
Disclosure – see Compromise			N/A		N/A	N/A
Destruction – see Compromise				N/A		

Modification – see Compromise				N/A	N/A	
Forgery – see Exploits, Compromise						
Enterprise Reputation			N/A	N/A		
Product Reputation – see Modification			N/A	N/A	N/A	
Contractual Liability			N/A			
Death, Incapacitation, Personnel Loss*		N/A	N/A	N/A		
Defection, Disgruntlement				N/A		
Systems Surveillance				N/A	N/A	
Systems Exploits*, Denial of Service				N/A	N/A	
Systems Compromise*				N/A		
Power Outage, Connectivity Outage						
Civil or Natural Catastrophe						

#### ***D. Contribution: Ranking and Valuation of Assets***

One contribution to community knowledge in this essay will be that a simple rank-ordering scheme discussed by numerous political scientists in the context of non-transitive voting and preferences ([Condorcet], [Saari], [Sen]) can be guaranteed to produce robust collective preference orderings. For a ranking of  $M$  objects by  $N$  participants, this requires only  $NM$  value assignments, rather than the  $NM^2/2$  value assignments required for the full-information pairwise resolution proposed by [Marchany].

When the number of systems and components goes above 30, the time saved is substantial, especially considering that this is shared meeting time being saved, with all the implications for stakeholder buy-in as well as credibility of the auditing process within the organization.

The procedure to follow assigns integer ranks of importance to each of the  $M$  systems and components listed, in increasing order for more important ones. The numbers are simply added, weighted or unweighted, to result in a robust vote score for each system. When there are 40 systems, each voter is required to assign 40 numbers unilaterally, rather than vote all together on  $1600/2$ , or 800 separate binary comparison votes.



Examples based on [Marchany], Appendix A, will follow in Part II.

In this case there are only six asset categories, and only three stakeholders in the organization, so the advantage of this improvement is not clear in the example, but the way in which the procedure is applied can be shown clearly. There can be ties in the ranking order. If there were more than 30 systems, or if there were more than ten or so stakeholders, then the advantages would be significant.

Ranking Votes	1) CEO/ President	2) Tech Director	3) Director Emeritus	Summary	Rank
System #1	6	6	4	16	1
System #2	1	3	2	6	5-tied
System #3	2	4	3	9	4
Home Office	4	1	1	6	5-tied
Financial	5	2	5	12	3
Remote Network	3	5	6	14	2

Clearly System #1 represents the most important collection of assets, followed by the remote network (including the web site), banking and accounting procedures, and System #3, the firewall router. The office's physical premises and System #2 are tied for the least important collections of assets.

#### **Analysis of Ranked Assets, and Value of the Risks Mitigated:**

Using matrix notation, consider  $A$  assets residing on  $S$  systems, each of which is exposed to  $R$  risks, addressable by  $P$  remedies, or controls. The matrix of asset values at risk *versus* remedies is  $(O \cdot D \cdot F)$ , where  $O$  is an  $A$  by  $S$  matrix of which assets reside on which systems,  $D$  is a  $S$  by  $R$  matrix of which systems are exposed to which risks (denoting what proportion of damage in each case), and  $F$  is an  $R$  by  $P$  matrix denoting which risks are mitigated by which remedies. Call this matrix the Value at Risk Mitigation matrix, or  $V$ .

Let a 4 by 3  $O$  be populated with asset value as follows:

	System #1	System #2	System #3
Asset 1: Dev Code	\$250K	0	\$100K
Asset 2: Good Name	0	\$100K	\$500K
Asset 3: Privacy Data	0	\$100K	0
Asset 4: Personnel	0	0	\$250K

Let a 3 by 5  $D$  (the potential damage) be populated with risk value as follows, the Damage Done numbers (subjective, between zero and one, assigned per checklist item, including notional frequency or likelihood) apply whenever a system has not passed the benchmark for the checklist item, otherwise there are zeroes. It is important to note that in this study, no effort will be made to make these estimates of damage done (damage times frequency, or likelihood) better than subjective estimates (see [Marchany]).

	Checklist item #1	Checklist item #2	Checklist item #3	Checklist item #4	Checklist item #5
Damage Done	0.1	0.5	1.0	0.5	0.1
System #1	0	0	1.0	0	0
System #2	0.1	0.5	0	0	0
System #3 (all tests passed)	0	0	0	0	0

Let a 5 by 6 **F** be populated with ones and zeroes depending whether the fix in the column will make the checklist item pass. Fractional numbers based on subjective judgment about the checklist item should be applicable. For example:

	Patch #1	Patch #2	Password policy	UPS and premises	Dedicated firewall	Armed guards
Checklist item #1	1	0	0	0	0	0
Checklist item #2	0	1	1	0	0	0
Checklist item #3	0	0	0	1	0	1
Checklist item #4	0	0	0	0	1	1
Checklist item #5	0	0	0	1	0	1

The resulting **V** matrix,  $(O \cdot D \cdot F)$ , should indicate the assets values mitigated by each of the corrective measures in the columns. Decisions taken are supported by this kind of analytical treatment.

	Patch #1	Patch #2	Password policy	UPS and premises	Dedicated firewall	Armed guards
Asset 1: Dev Code	0	0	0	\$250	0	\$250
Asset 2: Good Name	\$10	\$50	\$50	0	0	0
Asset 3: Privacy Data	\$10	\$50	\$50	0	0	0
Asset 4: Personnel	0	0	0	0	0	0

Each resulting column represents a fix to address risks, each row represents a list of asset values at risk that stand to be mitigated by undertaking the cost represented by the fix in each column. In a sense, each column sum should be greater than the cost of the remedy represented by that column in order for the fix to be worthwhile. In the example above both patches, a new password policy, and a UPS and premises security are appropriate and should be implemented. Armed guards are cost ineffective.

## ***E. Contribution: Auditing RedHat Linux 7.1***

There is no authoritative auditing procedure or CIS ruler available at this time to measure RedHat Linux v7.1, however we can use methods from [Laude] of a RedHat Linux 7.0 audit, and the CIS Solaris ruler to measure this system. The references in [Laude] to earlier Linux 6.x auditing are omitted because of the significant changes to Linux covered there.

A recap of tools and checklists, from [Laude] is as follows:

### **1. Tools:**

- Swatch, log monitoring.
- Psionic logcheck, log monitoring
- Logwatch, log monitoring

- Tripwire, file system integrity monitoring
- AIDE, file system integrity monitoring
- Psionic PortSentry, host based intrusion detection
- Tiger, vulnerability analysis
- TARA, vulnerability analysis
- SATAN/SARA/SAINT, vulnerability analysis
- Nessus, vulnerability analysis
- Nmap, vulnerability analysis
- ISS Internet Scanner, vulnerability analysis
- Cybercop, vulnerability analysis
- Snort, traffic sniffing/monitoring
- Tcpcdump, traffic sniffing/monitoring
- Ethereal, traffic sniffing/monitoring (author's own addition)
- System commands, diagnostic information about system

## 2. Checklists

- Securing Linux Step by Step [SANS]
- Auditing Linux [Naidu]
- Linux Security Auditing [Whelan]
- CIS Solaris ruler (author's own addition)
- <Anti-virus software> [Laude]
- <Physical security> [Laude]

The elements to be checked are listed briefly below, along with the source of the item, A= Author, C= CIS Solaris ruler documentation, L= [Laude]. Redundancies have been removed in the interest of economy, and some relatively subjective criteria have been included. Other sources such as the [CERT] checklist were minimal and a subset of these other checklists.

Checklist Item	Src	Method/Command	Benchmark
Kernel version/tool calibration	L	<b>uname -a</b>	Linux 2.4.2-2
Latest OS security patches/updates	L	<b>rpm -qa</b> compared w/patch versions recommended by RedHat	Same versions in <a href="http://www.redhat.com/support/errata/rh71-errata-security.html">http://www.redhat.com/support/errata/rh71-errata-security.html</a>
Recovery boot disk	L	Make a new one: <b>/sbin/mkbootdisk</b>	Bootable disk exists
Linux 7.1 Incident handling disk	A	Insert, <b>ls -al</b>	Should have at minimum: ls, lsof, netstat, bash, tcsh, dump, all built static
Only non-privileged user accounts are bona fide employees	L	<b>cat /etc/passwd</b> should show only known non-privileged users	Only bona fide accounts
Shadowed passwords, MD5 hashed	L	<b>md5sum</b> a known password and see if it matches content in <b>/etc/shadow</b>	Hash matches password entry in <b>/etc/shadow</b>
Every user has a shadowed password	L	<b>pwck</b> shows no errors	<b>/etc/shadow</b> shows password entries

System password policy matches security policy	L	Run <b>chage -l &lt;user&gt;</b> for each user in /etc/passwd, <b>crack</b> to test strength.	Passwords expire, and are all nontrivial
There is anti-virus software installed	L	<b>rpm -qa</b> to verify claimed software	Installed supported product, up to date
There are no shared filesystems	L	<b>cat /etc/exp*, exportfs, df -k</b>	None
There are no setuid or setgid files	L	<b>find / \( -perm -4000 -perm -2000 \) -print</b>	None, except ??? userhelper
Is the LILO boot-prompt password protected? Is lilo.conf 600 and root?	L	<b>cat /etc/lilo.conf, ls -al /etc/lilo.conf</b>	Password set, conf is root, 600
Reboot from console with CTRL-ALT-DELETE is disabled	L	<b>cat /etc/inittab   grep shutdown</b>	Key combination does not prompt for reboot
Single user mode requires root password	L	<b>cat /etc/inittab   grep sulogin</b>	No autologin, root password required
All console logins disabled except for root and administrative user	L	<b>cat /etc/security/access.conf</b>	Nope – users have to use the console
TCP wrappers are in use	L	<b>cat /etc/hosts.allow, cat /etc/hosts.deny</b>	Iptables, ipchains, all ports filtered
Remote telnet users are disallowed	L	<b>cat /etc/securetty</b>	None except as specifically required by policy
Only permitted ports are unfiltered, from the inside	L	<b>nmap -I -O -sR localhost</b> to see ports	Possible select service only on ftp, ftp-data, ssh ports
Only permitted services running, as seen from the inside, esp. no rpc*, lpd, named, or portmap.	L	<b>netstat -at</b> to see if any inappropriate services are running, <b>chkconfig --list</b> to see if any inappropriate services are configured	None except for X11, port 6000
No unusual or suspicious file descriptors are open	L	<b>lsdf -i +M</b> to list all open file descriptors	None except X11, port 6000
Only permitted ports are accessible from the outside	L	Use <b>nessus</b> for Solaris to perform scan from remote system.	None at all
Vulnerability assessment tool shows negative database match	L	Use <b>nessus</b> for Solaris to perform assessment from remote system.	None at all, no ports open
No .rhosts or hosts.equiv files anywhere on the system	L	<b>find / -name .rhosts -ls, find / -name hosts.equiv -ls</b>	None

Tripwire installed and configured using encryption	L	<b>Which tripwire, tripwire -m c</b> to see if it has been initialized properly, and uses an encrypted database, and is in cron.d	Should respond that database cannot be found, See Audit, Appendix A
Sendmail configuration is secure, in case SMTP is used	L	<b>cat /etc/sendmail.cf   grep DAEMON</b> and also <b>  grep Privacy</b> to make sure no daemon mode or remote commands work	DAEMON=no is present, and PrivacyPolicy at least has ... See Audit, Appendix A
Physical premises are secured	L	Terminal session times out after 10 minutes Safe contains the only records of passwords Physically locked safely when personnel absent Router is disconnected when personnel absent more than three days	Timeouts, safely locked, safely locked, and disconnected
Privileged users root, bin, daemon, gdm, xfs are present and have passwords	A	<b>cat /etc/passwd</b>	/etc/passwd shows only these and legit users
Appropriate UPS and Backups	A	Check them physically	Unplug mains, system remains up, test restoration
Groups are limited to only necessary ones, and all have passwords	A	<b>cat /etc/group</b>	See Audit, Appendix A
Iptables is running and configured appropriately	A	<b>iptables -L -line-number</b>	See Audit, Appendix A
Logging functions for cron, reboot, messages, security..	C	<b>tail /var/log/*</b> to make sure recent events have been logged. Generate some events, reboot, use ssh to test.	Known recent events, including reboot, ssh use, packets, are logged
Unusual surveillance and known exploits are noted.	A	Subjective – see systems administrator	Subjective
/etc/passwd, /etc/group, and /etc/shadow are 644, 400, root	C	<b>ls -al /etc</b> and examine permissions	-rw-r--r-- and -r-----
No users or groups are uid or gid of 0	C	<b>cat /etc/passwd</b> and <b>cat /etc/group</b>	None except root
No ‘.’ In any \$PATH variable	C	Log in as each user and <b>echo \$PATH</b>	None
No inappropriate or casual files exist in /root	C	<b>ls /root</b> (done as root)	Only bash, mail, xwindows-related

User home directories are all 755 or more restrictive	C	ls -al /home and examine permissions	-rwxr-xr-x Or more restrictive
User '.files should all be 755 or more restrictive	C	ls -al /home/* and examine permissions	Same

## F. Contribution: Auditing Windows 98

There is no authoritative auditing procedure or CIS ruler available to measure Windows 98, however we can use methods from the CIS Windows 2000 ruler to measure this system. Many of the tools used will be the same, or will be a Windows version of the same tool used to audit Unix systems.

The elements to be checked are listed briefly below, along with the source of the item, A= Author, C= CIS Solaris ruler documentation, S= [Scambray, McClure, Kurtz]. Items relevant only to domain controllers and network relationships are omitted, since no Windows workgroups or domains are allowed, other than local domain controllers and user authentication on isolated Windows 98 systems. Some items may have no known way to check or perform them under Windows 98/95, but would be worthwhile to keep on the list, in case an expert can contribute a method and hopefully a remedy.

Checklist Item	Src	Method/Command	Benchmark
Password policy is correct and enforced, min 7 length, nontrivial, and 90-day exp.	C	Using the Settings, Network dialog, the Primary Network Logon is "Biometrics Client"	Poledit.exe, Local Computer, Windows 98 Network, Password, Minimum password length. No local aging possible, enforce manually
Windows 98 is installed multi-user, <b>no/local</b> Windows network or domain, DHCP only, peripherals only on individual systems	A	Control Panel, Network, Identification shows local Workgroup and Computer name, check Printers, right mouse-button, Share... each	Not Shared
Account lockouts enabled for more than 20 logon attempts	C	Attempt 20 logons	Fails to log on
Security event logs appear to function correctly	C	Examine /Program Files/ESLogs/*.html	Shows latest logon, boot, other events
Task scheduler is only available to administrator	C	Attempt CTRL-ALT-DEL as user	Button disabled
ROM-BIOS password is set	A	Hard boot and try to edit CMOS/BIOS	Fails without password
Refuse startup without network logon	C	Press cancel on login dialog when prompted for boot logon	Cancel repeats logon prompt
CD/floppy autorun is disabled	A	Insert any CD with autorun.inf	No action taken
Inetd is disabled, with no services offered	A	Run task manager, check task bar	No inetd process

Log backups and restores	C	Check system logs	Backups are logged
Lock (screensaver) console after 10 minutes of no activity	C	Let system alone for 10 minutes as each user	System requires re-login
Clear virtual memory pagefile on shutdown	C	Not known for Windows 98	Not known for Windows 98
Remove last username from logon screen	C	"Don't show last user at logon" is checked	See Audit, Appendix B
Logon banners have legally binding warning text	C	"Logon banner" is checked and has text.	Test shows up on logon
Installation of drivers is prohibited except for admin	C	Policy for local users, Windows 98 System, Control Panel, System	Unknown for Windows 98
Rename the administrator account	C	Check Control Panel, Users	No such user as administrator
Only recognized user accounts allowed, no guest	C	Check Control Panel, Users	No unrecognized users defined
System has local firewall software installed and configured correctly	A	Check firewall control panel for ACLs	All ports filtered/drop except connections established locally
Biometric logon declines any nonmatching fingerprint for 5 lockouts, or 100 attempts.	A	Exhaust 100 logon attempts with incorrect fingerprint	Refuses all attempts
Browser security settings refuse all unsigned, prompts for signed applets/ActiveX, allows active scripting.	A	Open IE 5.5, select Tools, Internet Options, Security tab. Check all levels, each user.	All settings are correct for all zones: See Audit, Appendix B
All file and print sharing is disabled by policy	S	Policy has all file and print sharing disabled	Poledit.exe has items disabled: See Audit, Appendix B
Any exceptions to file sharing have share names ending with '\$'	S	Examine shared resources	Examine all shares: all names begin with "\$"
All dialup access is disabled by policy, or DUN 1.3 used	S	Policy has all dialup access/service disabled	Poledit.exe has items disabled: See Audit, Appendix B
Remote registry services are not installed	S	Policy Connect... to local host name is refused	No such services are available locally
<b>Reputable</b> antivirus software is installed and configured correctly	S	Check antivirus software control panel or UI.	McAfee, Symantec, Microsoft, PC-cillin, others?
Disable password caching for Windows 98	S	Policy has password caching turned off	Poledit.exe has items disabled: See Audit, Appendix B
Vulnerability assessment tool shows negative database	A	Use <b>nessus</b> for Linux to perform assessment	Nessus report shows no known

match		from inside firewall.	vulnerabilities
Registry is not writeable by non-privileged users	A	Use poedit.exe, Local User, Windows 98 System, Restrictions	Disable Registry Editing Tools is checked
LAN has UPS/power, backups performed regularly	A	Check physically	Functions unplugged long enough to power down, backups have recent changes

### ***G. Contribution: Auditing the Linksys BEFSR41***

There are no authoritative auditing procedures or CIS rulers available to measure any of the Linksys home Cable and DSL routers. In this case, an assortment of methods from [Northcutt], and manufacturer documentation must be used to measure this system. As of November 30, 2001, web references about the Linksys BEFSR41 can be found at the following links.

<http://www.mactechnologies.com/pages/tftpinst.html#linksys>

[http://www.practicallynetworked.com/support/linksys\\_router\\_help.htm](http://www.practicallynetworked.com/support/linksys_router_help.htm)

<http://www.linksys.com/products/product.asp?prid=20&grid=23>

This device can be treated as more or less a black box firewall combined with a web server and a tftp server available to the LAN addresses. There may or may not be other services running but hidden, available to either the LAN side or the WAN side, but documentation mentions only the web interface and a tftp update interface, presumably with the server component on the router and client in the update package. Since both web services and tftp services are prone to security vulnerabilities, more in-depth testing than is within the scope of this audit is strongly recommended by the author, and in a laboratory context. The router here is intended only to 1) provide NAT for an internal network, 2) forward all IP traffic to the designated DMZ host (system #1), and 3) filter out most unroutable and malformed IP packets.

The elements to be checked are listed briefly below, along with the source of the item, N= [Northcutt], A= Author, L= Linksys Corporation or related source, (e.g. Mac Technologies, the software contractor). Note that some tests are pertinent to the LAN ports, while others are relevant to the WAN side of the appliance.

Checklist Item	Src	Method/Command	Benchmark
Latest patches are installed	N	BEFSR41 4-port Cable/DSL router,	All patches on or before current date are installed
Vulnerability assessment tool shows negative database match	N	Use <b>nessus</b> for Solaris to perform assessment from remote system.	WAN side, LAN side each show no known vulnerabilities
Router has no users other than one administrator, this has a nontrivial password	N	Attempt to log in as default and admin, using same passwords, run brute force login attack.	Negative login



Have correct ISP-specified host, domain, and IP address or DHCP, and name servers	L	See ISP installation documentation.	Checks out with ISP, can ping name servers, DMZ firewall allowing
Remote login is disabled (unless ADSL requires it)	L	See Setup panel in web interface	Disabled
Subnet mask is minimal for actual number of systems	L	See Setup panel in web interface	As small as possible, 248 for 3-4 addresses
Router cannot force factory defaults restoration	A	Sniff http request to restore defaults, send on new unauthenticated session	HTTP 403, or 407
Number of DHCP users is minimal for network	A	See DHCP panel in web interface	Number of IP/NAT devices, including the router
Log viewing interface views in and out access logs	L	Compare with LogViewer application from <a href="http://www.linksys.com">www.linksys.com</a> , compare with third sniffer product logs	All traffic is logged, and logs can be archived
If ZoneAlarm or PC-cillin is in use from the Linksys router, then they are enforced, and only the DMZ firewall is exempted.	L	See Security panel in web interface	Security panel shows license key, enforcement checked, and no exemptions except firewall NAT IP
Port filtering implements secure ACLs, MAC addresses are filtered too	A	See Filters panel in web interface	Outbound ACL requirements implemented by port
There is no port forwarding in place for this router	L	See Forwarding panel in web interface	No ports forwarded
All Dynamic routing is disabled, gateway mode, not router mode	L	See Dynamic Routing panel in web interface	TX, RX both disabled, gateway mode
Static WAN routes exist only for static ISP gateways, or none if using DHCP for WAN side	L	See Static Routing panel in web interface	Each route in select box shows empty. Routing table has only three routes, WAN inbound and outbound, and LAN
DMZ Host is set to the Linux host address for System #1	A	See MDZ Host panel in web interface	192.168.1.n, for designated host n
Internal (LAN) addresses are away from 1 and 255, making surveillance more difficult	A	See Setup panel in web interface, LAN IP Address section	Start at 192.168.1.39 for example, requires static LAN routes

(Note: Last item in checklist contradicts items for minimal subnet mask, DHCP use, and minimum number of DHCP users – it may be of dubious value)

The web user interface for the Linksys Cable/DSL router is mostly quite intuitive, but sometimes idiosyncratic, for example, where the access control list is managed from the Filters panel: there are five port ranges that can be prohibited, and these appear from the logic to apply to outbound IP traffic, not inbound. An additional stateful firewall is required for meaningful active security. This is provided by the DMZ host, System #1.

## ***H. Contribution: Auditing a Remote System and Web Application***

There is no authoritative auditing procedure or CIS ruler available for web applications and user-interactive web sites in general, and so it will be necessary to apply methods described in [Rhoades], web application testing techniques [Nguyen] and the author's own software development experience to measure the corporate web application and the remote network that supports company email and auxiliary services. A simple application of the CIS ruler will be made to the Solaris 5.6 operating systems that run the remote network.

Unfortunately the remote system is under the control of a not-for-profit organization, and operates several other web sites for the benefit of other entities. This means that any functioning in any of the other organizations' web sites represent a security opening to the web server, and therefore a risk to the company's web site assets. All virtual hosts sharing the same system, especially web server, will generally have to be tested for security, to the extent that any system compromise is possible via any of them. The elements to be checked are listed briefly below, along with the source of the item, R= [Rhoades], A= Author, S= [Scambray, McClure, Kurtz], N= [Nguyen]

Remote system #1: DMZ host and web server

Checklist Item	Src	Method/Command	Benchmark
CIS Solaris 5.6 ruler score of 85 percent or better	A	<a href="http://www.cisecurity.com">www.cisecurity.com</a> , download the tarfile & run sara	75 percent or better
Vulnerability assessment tool shows negative database match	A	Use <b>nessus</b> for Linux to perform assessment from local system.	No security holes
SSH is actually secure	A	Use sniffer – e.g. hunt to read actual TCP content, esp. password	All communications other than prompts are unreadable

Remote system #2: IMAP/SMTP (email) server

Checklist Item	Src	Method/Command	Benchmark
CIS Solaris 5.6 ruler score of 75 percent or better	A	<a href="http://www.cisecurity.com">www.cisecurity.com</a> , download the tarfile & run cis	75 percent or better
Vulnerability assessment tool shows negative database match	A	Use <b>nessus</b> for Linux to perform assessment from local system.	No security holes
IMAP is actually secure	A	Use sniffer – e.g. hunt to read actual TCP content, esp. password	All communications other than prompts are unreadable

Web Applications:

Checklist Item	Src	Method/Command	Benchmark
The web server product cannot be identified easily	R	telnet to port 80	No or inaccurate banners
No default install materials remain available	R	Try "default.*" in URL in all possible forms	All 404's, not found
Available web map is correct	R	Try each location	All 400's, all there
No well known executables are installed in, linked to document root	R	Try appending perl, perl.exe, python, python.exe, csh, to each path in the site	No responses, all 404's
Site server is set to resist mirroring applications	R	Mirror the site, multiple times if necessary	Lockouts after many requests, difficulty
Robots.txt is set properly in each document root	R	ls -al in the document root folder, from inside	Robots.txt says no robots
HTML contains no unintended name tags or comments	R	Examine served HTML, look for action, method, name, <!--, <script, javascript, //, other usual suspects	No inappropriate comments, subjective, some may be acceptable
HTML and javascript are obfuscated or compressed	R	Examine served HTML	Hard to read in vi or notepad
If HTTPS, encryption level requires 128 bit RSA or better	R	Use Netscape, turn off SSL v2 encryption ciphers from lowest up	Requires only 128 bit or better
Attempts to manipulate boundary and extreme values of candidate application variables do not reveal important or private information	R	List relevant application variables ("name=") and values ("value="), note application roles, submit test suite forms to see error codes and results	Error messages are generic and have no debug information, or application info
Browser cache does not cache private information	R	Maximize cache, examine cached pages	No private form responses, or pages with private info
If Certificate Authentication, agency is trustworthy, and only one session is allowed	R	Try to spoof signer, or show it can be forged, try multiple concurrent auths	Multiple session authentications fail, with no information revealed
If CA, then the way the certificate is authenticated is secure	R	MD5 signatures and PGP public signatures match (best effort)	Unbroken chain of authentication
If form-based authentication, the form, or at least the action is HTTPS	R	Sniff the login. Check the url of the form, and the form's action attribute	No passwords or other private info is plaintext

If secure form-based auth is used, then additional token or other factor is used	R	Check the login form	Smartcard, time token, or biometric id
If HTTP basic authentication is used, the initial URL is HTTPS	R	Sniff the login to make sure, check the url	HTTPS
Generally, there is no ability to authenticate at different scopes, global, session, and request, as different users, except as specified	R	Try to use several different sets of credentials concurrently each from the other	Only one scope at which authentication is done.
There is no ability for concurrent logon from different addresses	R	Try to do this from different addresses	Authentication fails with minimal info message
If any auth error, report all verifiable user names, and if possible, passwords	R	Brute force it if there is any way to confirm existence from error messages returned	Lockout preferable, or generic error message
There is an authentication lockout and renewal policy	R	More than n invalid auth attempts lock users out	Locked out pending email request, or similar
For heavy traffic sites, sign-on timeouts and load balancing is in proper order	R	Use Webcracker to open many concurrent sessions	No lockups that are not intentional (see above, mirroring)
If auth is used, then sign-off does actually sign the user off	R	Try to access previous resources from a signed-off session, sign off multiple times	Access denied as though never authenticated
Any application variables used for session tracking are encrypted or obfuscated	R	Determine the session tracking mechanism, if any, See if it can be predicted.	Impervious to astute analysis, subjective
Any cookies containing sensitive information are encrypted and have full identifying information included	R	Examine all cookies, and sniff their transit to confirm	All encrypted
If there is auth used, and if the session tracking is predictable, then concurrency from different IP's disallowed	R	Try to simulate a session id from a different address while logged on from the first	Multiple sessions from different IPs forbidden
Session inactivity timeouts are reasonably short	R	Leave a session inactive	Less than about 15 minutes
Form submissions are all POSTs rather than GETs	R	Examine all form action attributes	No GETs
Web sites allowing user input perform filtering for CSS and other malicious code	R	Procedures for serving user-defined HTML and customization	All user input is filtered rigorously, subjective

Product-specific vulnerabilities are scanned for esp. IIS, ColdFusion, JRun	S	See <a href="http://www.cisecurity.org">www.cisecurity.org</a> or <a href="http://packetstorm.decepticons.org">http://packetstorm.decepticons.org</a> for the latest product scanners	Product ruler exists and has 75 or 90 percent level results.
Server request logs are monitored for surveillance, DoS, and legitimate use patterns	A	Subjectively, the level of attention is sufficient to preempt intrusion and adapt to usage	Daily intrusion check, monthly usage review

### ***I. Score, Remedial Action List, and Actions Taken***

The audit report on each of the systems above will include a referral to an appendix containing the audit results and benchmark comparisons. There should also be an appendix containing an overall **V** or Value at Risk Mitigation matrix to indicate which corrective measures should be taken. The score on the checklist will be reported and discussed briefly, and a list of remedial actions for the checklist enumerated. A paragraph on recommended actions taken for each system will be made at the end of each system's section in the report, and an overall comment made by both auditor and executive for remedial actions taken will be made in summary.

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[http://www.cisecurity.org/bench\\_win2000.html](http://www.cisecurity.org/bench_win2000.html), PDF-format documentation from zipfile
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[http://www.cert.org/tech\\_tips/usc20\\_essentials.html](http://www.cert.org/tech_tips/usc20_essentials.html), <http://www.cert.org/archive/html/analysis-method.html>
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- Scambray, McClure, Kurtz “Hacking Exposed” McGraw Hill 2001, ISBN 0-07-212748-1
- Sen, Amartya “The Impossibility of a Paretian Liberal”, 1970, Journal of Political Economy 78(1): 152-57
- Further reading on voting, rank-ordering, non-transitive voting schemes, robust voting, etc. – Requires academic affiliation, or fee-based membership:  
American Political Science Review <http://www.jstor.org/journals/00925853.html>  
American Journal of Political Science <http://www.jstor.org/journals/00030554.html>

## **Part II: Auditing a Real World Small Business:**

### **Generic Services Corporation**

#### ***A. Executive Summary***

The exposure of IT assets for Generic Services Corporation (a fake name to satisfy GIAC examination criteria) is at an acceptably low level, being primarily exposed due to lack of control over physical premises, certain kinds of web hacking, general lack of adequate local firewall and antivirus capability, and lack of Windows 98 system event logging. These weaknesses in the overall security schema are mitigated by adequate external network security. There is no compelling issue or gaping security hole anywhere. Other remedial measures such as purchase of a safe, purchase of reliable UPS capability, possible web site relocation, and compromise recovery capability (i.e. incident handling capability) appear to be of significant value in reducing the overall risks to this corporation for loss or revelation of critical data, interruption of operations, and defacement or damage to web assets. These measures are cost effective, and should be implemented.

The overall present value of the entire enterprise's future, however big or small, is at stake due to the core function of the business being network security itself. The only significant assets of the firm are those in the IT department, unlike some other businesses. Consequently, however small the amount of value at risk that is mitigated by these corrective measures appears to be, it represents a critical measure of success for this entire company. It is imperative therefore that all or most of the corrective measures described in the matrixes in Appendix F be implemented.

#### ***B. The Organization***

Generic Services Corporation is a closely held Delaware "S" corporation founded in 1994, and has done no business between Fiscal Years 2000 and 2001. The author was fortunate enough (perhaps) to be able to purchase this corporation along with all its assets and prior relationships for a small sum. Currently, operations are being revived with both prior and new clients, and the business of the company is being defined and focused.

The founders of this corporation are 1) a US Naval Academy graduate (1963) who later taught the first computer science courses there, 2) one of the original DARPA systems administrators who had discovered and helped eliminate the Morris worm threat (the first known Internet worm in 1988), and 3) a penetration and exploit expert who is currently employed attacking and testing defense department networks. All three remain principals and co-owners.

The business has in the past included custom software and services, mixed together as needed for any specific project. However, the new management has decided to focus the firm's attention on security services and standard service offerings. Some of these are installation, while others involve more general business practice consulting and expert legal testimony. The network certification and auditing offering, however, is new, and will feature GIAC-certified audit personnel, CIS rulers, and any other broad standards that are available. The flagship example of this auditing service will be this essay.

(write to [email@address](mailto:email@address) for more information)

#### ***C. IT Systems and Assets***

The company has few and simple assets compared to a large, complex operation in the same business, such as Symantec, or Counterpane, and it would be the author's desire to show a more comprehensive example of enterprise IT auditing procedure. However,

the assets here should be representative enough to make a helpful example for small businesses, where this function is sorely needed, but who also need to spend minimal resources on non-revenue generating activities such as auditing.

These assets are grouped into two collections, by physical locale: Locally, there are one Pentium Linux system (System #1, custom built with 233Mhz, Ethernet and USB, 12G disk), functioning as a firewall, product development machine, and service attack/evaluation machine ("attack dog"), and one Pentium laptop (System #2, Dell Inspiron 7000 with 133Mhz, 9GB disk, and PCMCIA) for operations needs. A shared monitor and keyboard will be considered part of the laptop system. One Linksys cable/DSL router (BEFSR41), cabling, and printer constitute most of the office equipment and supplies assets, plus there are some miscellaneous other supplies. Local assets also include some PKI elements: private keys and trusted signatures of other entities.

Assets and the systems they occupy are enumerated as follows:

Asset	Location	Size of Possible Harm to Asset (1,000's of \$)
Product development code, project #1	System #1	\$100K
Service Contracts with client-specific charges and fees	System #2	\$250K
Email records with strategy and shareholder discussions	System #1, and remote #2	\$1,000K
Web site HTML and CGI code/objects.	Remote #1	\$100K
Server system logs, individual system logs	System #1	\$100K
File system integrity databases	System #1	\$100K
Password and related files with user information	System #1, System #2	\$1,000K
Device configuration, ACL's and administrative passwords/backdoors	System #1, System #3	\$100K
Web site appearance – proxy for perceived quality of service	Remote (the web server)	\$250K
Personnel private records	System #2	\$10K
Gateway/firewall routers and top layers	ID: System #3	<\$1K
Desktop PCs: x86/Linux	ID: System #1	\$2K
Laptops: x86/Windows	ID: System #2	\$2K
Office supplies, electronics	Home Office	\$2K

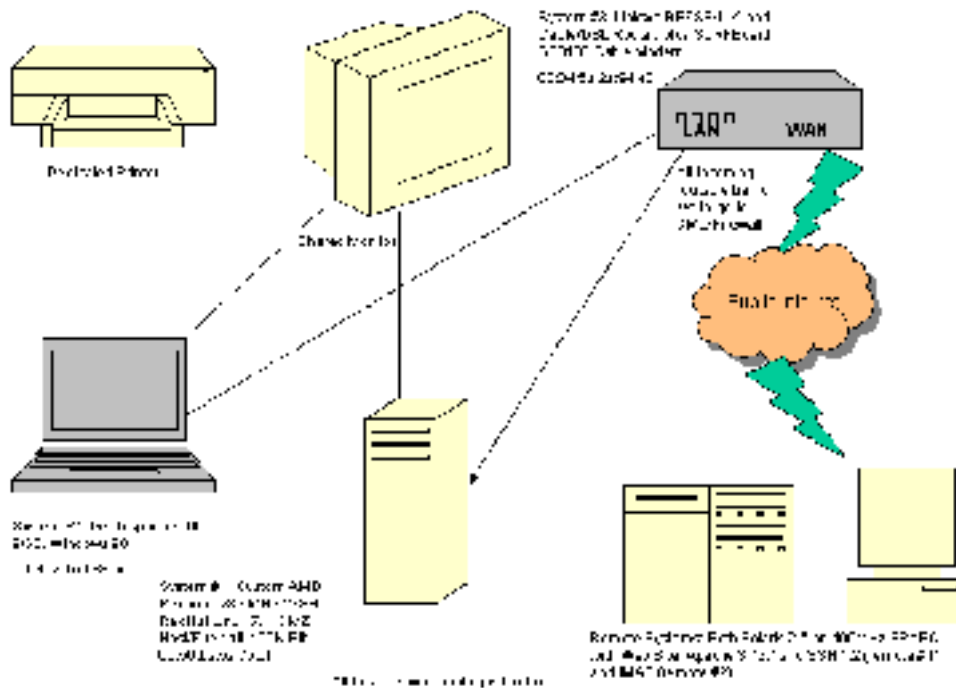
From the enumeration of assets, the systems to be audited will #1, #2, #3, and remote systems #1 and #2, plus a brief coverage of the home office premises. Attention to this latter premises checklist will be omitted from this audit. The asset estimates to some extent may double-count enterprise asset value predicated on those informational assets. However it is assumed that the risks to these assets are independent of each other, and can be mitigated independently.

The primary sources of risk to these assets are from outside hacking and exploits, network surveillance that might reveal private information, and compromise of physical premises, allowing access to consoles, CD Rom drives, hard drives that could be removed, devices that could be planted, and access to physical machines and sensitive data storage on their physical media. Any of these sources of risk can potentially harm or reveal the assets listed above.



A network diagram describing the systems and their relationship follows:

The remote systems contain the production web site and the site's HTML code. The IT systems to be audited are system #1, system #2, system #3, and remote systems #1 and #2, including the web sites run by remote system #1.



## D. Audit Results

### 1. System #1

The Linux DMZ host, development box, and attack dog, currently attains a score of 30 out of 38, or about 79 percent on the unweighted checklist. Being an internal audit, permission was available to correct some items during the course of the audit, if in the administrator's subjective judgment it would take little time to do so. Prior to these corrections, the unweighted score would have been less than 58 percent.

Remaining corrective actions to be taken include purchase of a safe and a reliable UPS system, more frequent backups, an incident handling disk with statically compiled applications, setting a LILO password and an Xwindows inactivity timeout, and some setuid related systems administration adjustments. The estimated amount of cost, time, and effort to perform these corrections is on the order of \$1000, taking about 6-8 employee days.

These actions are supported by the fact that they reduce risks significantly to strategically sensitive email records, and system-compromising assets such as passwords. The most important remedial actions to take are purchase of a safe

for premises password security (and other security), and creation of an incident handling disk. See Appendix A for more details of the audit.

## **2. System #2**

The Windows 98 operations and user applications machine currently attains a score of 19 out of 29, or just over 65 percent on the unweighted checklist. Prior to correction of some items during the course of the audit, the unweighted score would have been about 48 percent.

Corrective actions still remaining to be taken on System #2 include Local firewall and antivirus software, Task scheduler restrictions, driver installation restrictions, system event logging, pagefile clearing on shutdown, more frequent backups, and purchase of a UPS. The order of cost, time, and effort required to correct these is on the order of \$500 and five to seven days of employee days to address these items.

Most important and cost effective of these items is the local firewall and antivirus software, and system logging, while the user restrictions seem most questionable as far as risk mitigation and time spent. See Appendix B for more details of the audit of System #2, the Windows 98 laptop.

## **3. System #3**

The Linksys BEFSR41 home 4-port Cable/DSL router is a home network appliance that is fast growing in popularity, mainly because of its low cost and its turnkey nature. It may seem *ex ante* similar to writing a book report on an ABC's textbook (an exercise in pure procedure without any added value), but it is important to know the security implications for the network as a whole, and the organization's IT assets.

Upon auditing, this system scores twelve out of sixteen possible checklist items, or 75 percent. None of the items discovered out of compliance could be addressed during the course of the audit. It is anticipated that changing items that *can* be fixed could add some small degree of extra security while costing approximately 1 to 2 days of employee time. See Appendix C for more details of the audit of System #3, the Linksys router.

In summary, while unarguably cost effective, there are also a number of logging deficiencies and LAN side vulnerabilities and deficiencies. However, there seem to be no glaring problems on the WAN side of the device. Product note: Beware of using this device within a wireless context, or as a general router, and thoroughly investigate the Linksys wireless appliances in future for the same reasons. Do not use this device as the DMZ host and expect to have meaningful security.

## **4. Remote System #1, plus Web Site**

There are SSH, SMTP, and HTTP services, which all appear to be reasonably secure with the exception of the obsolete web server version. The web application uses no HTTPS, authentication, or cookies, and is not vulnerable as such on any of these counts, however two other web sites run as different virtual hosts by the same server are somewhat at risk due to the custom CGI in use for administrative login. Application testing for these additional web applications is outside the scope of this audit, and this risk is irreducible unless web hosting arrangements are altered.

This system scores 60 percent, or 12 out of 20 on an unweighted checklist. This may overweight some of the web application testing at the expense of the overall system checklist testing. For example it may be that the CIS Solaris ruler or Nessus scan results should be weighted more heavily than whether or not the web site's cookies are encrypted. A concern here is that the CIS Solaris ruler

was not permitted by the remote network owner and operator, and so internal measures of security are unknown. See Appendix D for more details of the audit of remote system #1, the SSH/SMTP/HTTP server.

## **5. Remote System #2**

Remote system #2 represents minimal risks, as it is used exclusively for email service via IMAP. The IMAP service is protected by two firewalls permissioned for individual IP access, and so vulnerability is low. However system internal security conditions inside the perimeter could not be ascertained by using the CIS Solaris ruler or an internal vulnerability scan, due to the network owner's hesitancy to grant root access.

Overall the system scores passes on two out of three checklists (67 percent), failing the CIS checklist, passing the external Nessus scan, and passing the IMAP traffic sniffing test. Due to the minimal nature of the services provided, this scanning is deemed sufficient to decide whether to keep or replace this email service. The only other solution is to request an updated IMAP daemon from the system owner.

## ***E. Auditor and Executive Comments***

The management in this case has represented a benchmark for the desired level of cooperation and participation in this audit, and cannot be thanked enough for their assistance. It cannot be anticipated that in future audits or those of other companies or departments that this level of cooperation can again be expected. There are still remaining risks to be contended with that are outside the scope of the IT department, for example, finances, personnel loyalty, leased premises, and business conditions. All of these can have an impact on information assets and their safety, and are left uncovered by this technology audit.

It is imperative for the ongoing survivability of this company that its only significant assets, those in the IT department, should be protected at all costs up to a significant fraction of the firm's entire net present value.

Assuming that all the recommended corrective measures described in the matrixes in Appendix F are implemented, the remaining risks to the corporation's IT assets will be a small fraction of the value of those assets, expressed on an annual basis. To recap, these measures are: 1) Placing written passwords in a safe (to be purchased), 2) Xwindows screensaver timeout, 3) setuid issues clarified, 4) LILO password set, 5) An incident handling disk for Linux 7.1, 6) A UPS (to be purchased), 7) local Windows 98 firewall and antivirus software (to be purchased), 8) Windows task scheduler and driver install restrictions, 9) Windows 98 system/event logging, 10) Windows pagefile clearing on shutdown, 11) Outbound router ACL's, 12) static LAN routes, 13) secure DNS servers, 14) Apache update, 15) Web site corrections (robots.txt, comments, and compressed HTML), and 16) an updated IMAP server.

The practices currently in place at Generic Services Corporation are, with the exception of some logging, backups, and screen saver timeouts, current state-of-the-art for any reasonably prudent commercial IT department, and we endorse those practices, conditional on the remedial measures described above having been taken.

Comment dated December 13, 2001:

David M Eaves

**Executive response:**

All remedial measures described in Appendix F have been, or will be taken within 30 days of this comment, except for updating IMAP and Apache on the remote systems and the router modifications. However, a singular situation exists with respect to the remote systems. These are run by one of the firm's founders, whose good will is essential to maintaining some business relationships. These relationships, like the risks, are also worth an amount comparable to the entire present value of all future earnings of the firm. The remote network owner may be from time to time temporarily unavailable, preventing remote systems security issues from being dealt with quickly, we can only anticipate a reasonably timely correction of such issues as they may arise.

It is recognized that assets, particularly web assets on these remote systems are at risk, but they will simply have to remain at risk until such time as additional features are added to the corporate web site (e.g. credit card acceptance for software downloads) that represent some additional risk, which requires more secure hosting premises. The same situation applies to email services provided (also hosted for free). The fact that both of these services are provided free of charge does not mitigate the risk that these remote systems pose to our information assets, and as revenue and ongoing relationships permit (or as medical conditions may require), Generic Services Corporation will move those assets elsewhere.

December 14, 2001, Generic Services Corporation

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## ***F. Lessons Learned for Future Auditing***

- Procedurally, it should be emphasized that firewall settings must accommodate any external vulnerability scanning activity. The scanning system must completely permission the subject system for returning traffic, while the subject system must set their permissions to treat the scanning system as it does any other system on the Internet. Planning for this in advance can prevent the need to re-scan repeatedly, saving large amounts of time.
- The analysis methodology may multiply count the value of corrective measures that apply to more than one system. This should be investigated.
- Security is easy when few publicly available services are offered. With more services offered comes more risk.
- The analysis methodology proposed is multiply counting the risk reductions, by asset, and might usefully account for those risks' statistical independence.
- Many methodologies exist and can be used for a process template, it is only important to select and use –one- that is sufficient for the desired purposes. The author wasted weeks trying to select one from among many. This seems best for most small IT departments.
- The major source of risk to assets turns out to be less from Internet intrusion than from other older and more well known sources: premises intrusion and personnel defection. More emphasis should be placed here, even for a technology audit.
- Top ten and top twenty scanning should still probably supplement these benchmarks, as an additional scoring or checklist item. It was judged here that these would probably have been done as part of Nessus' vulnerability scanning, but to be sure, and to corroborate, the CIS top twenty scanner could easily have been deployed, and was not.
- This has been educational, but now what needs to happen is that a “mini-CobiT” or some sanctioned lightweight audit procedure like this needs to be developed for smaller commercial IT orgs.

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# Appendix A: Benchmark and Matrixes, System #1

```
> uname -a
Linux <hostname>.<domainname> 2.4.2-2 #1 Sun Apr 8 20:41:30 EDT 2001 i686 unknown
```

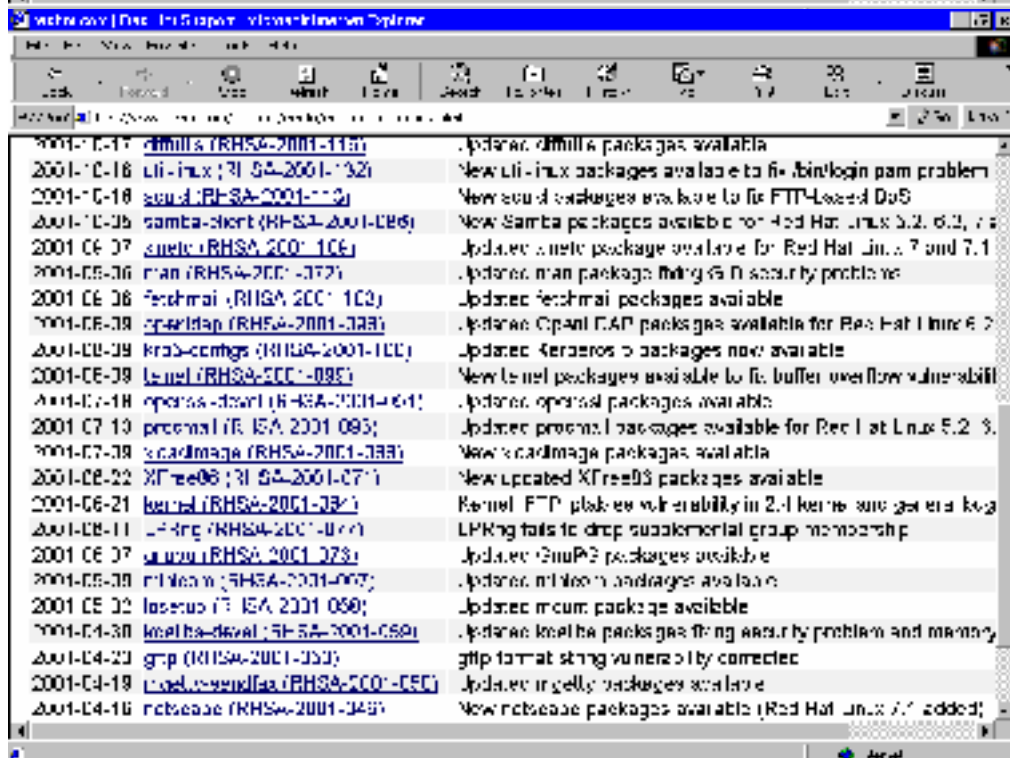
Installed packages follow. List formatting (rpm -qa) is not preserved:

```
yp-tools-2.4-7, gftp-2.0.7b-3, mount-2.10r-5, gnome-games-devel-1.2.0-10, nkf-1.92-4, e2fsprogs-devel-
1.19-4, gqview-0.8.1-3, vim-minimal-6.0-0.27, dump-0.4b21-3, db1-1.85-5, magicdev-0.3.5-3, hotplug-
2001.02.14-15, tclx-8.2.0-53, docbook-dtd30-sgml-1.0-10, compat-libstdc++-6.2.2.9.0.14, byacc-1.9-18,
cdecl-2.5-17, gtk-engines-0.10-12, dhcpcd-1.3.18p18-10, gcc-g77-2.96-81, nscd-2.2.2-10, gnome-objc-
1.0.2-11, python-xlrrpc-1.4-1, procs-2.0.7-8, ncurses-devel-5.2-8, sysklogd-1.4-7, emacs-X11-20.7-34,
dia-0.86-4, net-tools-1.57-6, minicom-1.83.1-5, esound-devel-0.2.22-1, netpbm-9.9-5, locale config-
0.2-4, dev86-0.15.0-5, sendmail-cf-8.11.2-14, libstdc++-devel-2.96-81, efax-0.9-8, openssh-clients-
2.5.2p2-5, gpm-1.19.3-16, sed-3.02-9, libtermcap-devel-2.0.8-26, pwdb-0.61.1-1, rpm-4.0.2-8, gpm-
devel-1.19.3-16, textutils-2.0.11-7, readline-devel-4.1-9, rootfiles-7.0-4, kernel-headers-2.4.2-2,
libjpeg-devel-6b-15, file-3.33-1, psmisc-19-4, sh-utils-2.0-13, rep-gtk-gnome-0.15-3, gnome-applets-
1.2.4-3, glib-devel-1.2.9-1, ical-2.2-21, librep-0.13.3-1, util-linux-2.10s-12, flex-2.5.4a-13,
readline-4.1-9, indent-2.2.6-1, procmail-3.14-6, modemtool-1.22-3, libole2-0.1.7-2, libgal3-0.4.1-3,
gnome-utils-1.2.1-5, tix-4.1.0.6-53, mktemp-1.5-8, cpio-2.4.2-20, binutils-2.10.91.0.2-3, gzip-1.3-12,
gnome-pim-1.2.0-9, cproto-4.6-7, ncurses-5.2-8, emacs-20.7-34, docbook-dtd41-sgml-1.0-10, extace-
1.1-1, groff-1.16.1-7, python-devel-1.5.2-30, wget-1.6-2, ltrace-0.3.10-5, rhn_register-1.3.1-1,
guile-1.3.4-12, chkconfig-1.2.22-1, pygnome-1.0.53-7, gnome-libs-devel-1.2.8-11, netcfg-2.36-3, krb5-
libs-1.2.2-4, setup-tool-1.7-2, ORBit-devel-0.5.7-3, rmt-0.4b21-3, initscripts-5.83-1, gnome-objc-
devel-1.10.2-11, kbdconfig-1.9.12-1, gnome-pim-devel-1.2.0-9, texinfo-4.0-20, iptables-1.2.1a-1,
tmpwatch-2.7.1-1, db2-2.4.14-5, openssh-2.5.2p2-5, tripwire-2.3-47, quota-3.00-4, ppp-2.4.0-2, hdparm-
3.9-6, pump-0.8.11-1, XFree86-tools-4.0.3-5, ucd-snmp-4.2-12, gnorpm-0.96-1, pam_krb5-1.31-1,
pciutils-devel-2.1.8-19, mailx-8.1.1-20, sgml-common-0.5-5, fileutils-4.0.36-4, netpbm-progs-9.9-5,
audiofile-devel-0.1.11-1, make-3.79.1-5, db2-devel-2.4.14-5, gd-devel-1.8.3-7, pygnome-libglade-0.6.6-
7, pnm2ppa-1.04-1, less-358-16, db3-utils-3.1.17-7, ncftp-3.0.2-1, libgtop-1.0.10-3, freetype-devel-
2.0.1-4, raidtools-0.90-20, gmp-devel-3.1.1-3, perl-5.6.0-12, alchemist-0.16-3, glade-0.5.9-5,
cracklib-2.7-8, ORBit-0.5.7-3, pam-0.74-22, 4Suite-0.10.1-1, expat-devel-1.95.1-1, control-center-
devel-1.2.2-8, bind-utils-9.1.0-10, python-1.5.2-30, newt-devel-0.50.22-2, imlib-1.9.8.1-2, termcap-
11.0.1-8, umb-scheme-3.2-18, mkxauth-1.7-15, gtk+-devel-1.2.9-4, gmc-4.5.51-32, logrotate-3.5.4-1,
groff-perl-1.16.1-7, gcc-2.96-81, libtool-1.3.5-8, rep-gtk-libglade-0.15-3, dip-3.3.70-22, kudzu-
0.98.10-1, control-center-1.2.2-8, arptools-2.1a10-39, rep-gtk-0.15-3, slang-1.4.2-2, ftp-0.17-7,
gnome-core-devel-1.2.4-16, njamd-0.8.0-3, zlib-1.1.3-22, filesystem-2.0.7-1, time-1.7-13, netscape-
communicator-4.76-11, imlib-devel-1.9.8.1-2, gtop-1.0.11-3, man-pages-1.35-5, vim-common-6.0-0.27,
XFree86-twm-4.0.3-5, kernel-source-2.4.2-2, bash-2.04-21, sharutils-4.2.1-7, rxvt-2.7.5-15, openssh-
askpass-2.5.2p2-5, cpp-2.96-81, libtiff-devel-3.5.5-10, losetup-2.10r-5, gtk+-1.2.9-4, ypbind-1.7-6,
bdfush-1.5-16, xisdnload-1.38-39, bzip2-1.0.1-3, tk-8.3.1-53, gd-1.8.3-7, db3-3.1.17-7, xscreensaver-
3.29-3, libtool-libs-1.3.5-8, wvdial-1.41-12, gnome-games-1.2.0-10, gnome-audio-1.0.0-12, diffutils-
2.7-21, telnet-0.17-10, ImageMagick-5.2.7-2, rhn_register-gnome-1.3.1-1, bzip2-devel-1.0.1-3, strace-
4.2.20010119-3, ed-0.2-19, libxml-1.8.10-1, autoconf-2.13-10, setup-2.4.7-1, grep-2.4.2-5, switchdesk-
3.9.5-1, gdk-pixbuf-0.8.0-7, Mesa-3.4-13, cyrus-sasl-devel-1.5.24-17, gimp-devel-1.2.1-5, kudzu-devel-
0.98.10-1, lrzsz-0.12.20-7, man-1.5h1-20, setserial-2.17-2, utempter-0.5.2-4, control-panel-3.18-4,
libglade-0.14-3, kernel-2.4.2-2, internet-config-0.40-1, printconf-gui-0.2.12-1, db1-devel-1.85-5,
libpng-devel-1.0.9-1, Xaw3d-devel-1.5-9, redhat-logos-1.1.2-3, gawk-3.0.6-1, mkbootdisk-1.4.2-1,
gnome-libs-1.2.8-11, docbook-dtd31-sgml-1.0-10, Mesa-devel-3.4-13, gmp-3.1.1-3, LPRng-3.7.4-22,
libgnomeprint11-0.25-9, desktop-backgrounds-1.1-4, mpage-2.5.1-5, tar-1.13.19-4, gnupg-1.0.4-11, rp-
ppoe-2.6-5, perl-SGMLSPM-1.03ii-4, gdk-pixbuf-devel-0.8.0-7, lsof-4.51-1, rsync-0.17-10, aumix-2.7-
2, libhttp-devel-1.0.8-2, mc-4.5.51-32, sudo-1.6.3p6-1, slocate-2.5-5, nfs-utils-0.3.1-5, pmake-1.45-
1, libungif-4.1.0-7, glibc-common-2.2.2-10, tcsh-6.10-5, anacron-2.3-16, rpm-devel-4.0.2-8,
libtermcap-2.0.8-26, rwho-0.17-10, SysVinit-2.78-15, devfsd-2.4.2-2, gedit-0.9.4-3, krb5-devel-1.2.2-
4, gal-0.4.1-3, tcl-8.3.1-53, timeconfig-3.2-1, patch-2.5.4-9, switchdesk-gnome-3.9.5-1, mailcap-
2.1.4-2, lilo-21.4.4-13, xchat-1.6.3-4, rpm-build-4.0.2-8, tksysv-1.3-2, talk-0.17-9, rsh-0.17-2.5,
gcc-c++-2.96-81, libxml-devel-1.8.10-1, lokkit-0.43-6, glib-1.2.9-1, krbafs-1.0.5-1, xtt-fonts-
0.19990222-9, tamago-4.0.6-4, qt-2.3.0-3, pygtk-libglade-0.6.6-7, words-2-16, libglade-devel-0.14-3,
statserial-1.1-20, mingetty-0.9.4-16, gq-0.4.0-2, docbook-dtd40-sgml-1.0-11, gdbm-1.8.0-5, xsri-1.0-8,
libstdc++-2.96-81, timetool-2.8-1, docbook-utils-0.6-13, redhat-release-7.1-1, gettext-0.10.35-31,
mouseconfig-4.21-1, ee-0.3.12-3, chkfontpath-1.9.5-1, bison-1.28-5, rcs-5.7-14, esound-0.2.22-1,
expect-5.31-53, gnome-print-0.25-9, indexhtml-7.1-2, Xconfigurator-4.9.27-1, XFree86-xdm-4.0.3-5,
libpcap-0.4-39, netscape-common-4.76-11, libunicode-0.4-4, gnumeric-0.61-9, basesystem-7.0-2, urw-
fonts-2.0-12, pythonlib-1.28-1, cyrus-sasl-1.5.24-17, stat-2.2-2, finger-0.17-7, VFLib2-2.25.1-12,
MAKEDEV-3.1.0-14, Xaw3d-1.5-9, openjade-1.3-13, eject-2.0.2-7, gnome-core-1.2.4-16, openssh-askpass-
gnome-2.5.2p2-5, openldap-2.0.7-14, stunnel-3.13-3, XFree86-libs-4.0.3-5, ucd-snmp-utils-4.2-12, nmap-
2.53-1, libjpeg-6b-15, XFree86-75dpi-fonts-4.0.3-5, gnome-users-guide-1.2-3, vixie-cron-3.0.1-62,
imlib-cfgeditor-1.9.8.1-2, openssl-0.9.6-3, gdbm-devel-1.8.0-5, openssl-devel-0.9.6-3, XFree86-100dpi-
fonts-4.0.3-5, rpm-python-4.0.2-8, authconfig-4.1.6-1, rsync-2.4.6-2, ntsysv-1.2.22-1, pidentd-3.0.12-
4, memprof-0.4.1-3, cracklib-dicts-2.7-8, at-3.1.8-16, m4-1.4.1-4, cvs-1.11-3, ctags-4.0.3-1, pygtk-
0.6.6-7, psutils-1.17-10, popt-1.6.2-8, gdb-5.0rh-5, glibc-devel-2.2.2-10, up2date-2.5.2-1, modutils-
2.4.2-5, ash-0.3.7-1, db3-devel-3.1.17-7, diffstat-1.27-5, bug-buddy-1.2-3, pump-devel-0.8.11-1,
which-2.12-1, screen-3.9.8-3, isdn4k-utils-3.1-39, whois-1.0.6-1, newt-0.50.22-2, libungif-devel-
4.1.0-7, iproute-2.2.4-10, ipchains-1.3.10-7, fortune-mod-1.0-13, freetype-2.0.1-4, rp3-1.1.10-1,
gnome-audio-extra-1.0.0-12, up2date-gnome-2.5.2-1, libhttp-1.0.8-2, openldap-clients-2.0.7-14,
printconf-0.2.12-1, ghostscript-fonts-5.50-3, info-4.0-20, tcp-wrappers-7.6-18, libpng-1.0.9-1,
usermode-1.42-1, sgml-tools-1.0.9-9, pam-devel-0.74-22, iputils-20001110-1, autofs-3.1.7-14, gdm-
2.0beta2-45, bc-1.06-2, tkinter-1.5.2-30, e2fsprogs-1.19-4, passwd-0.64-1, sawfish-0.36-7, openldap-
devel-2.0.7-14, sendmail-8.11.2-14, dosfstools-2.2-8, arts-2.1.1-5, emacs-nox-20.7-34, expat-1.95.1-1,
```

```

libtiff-3.5.5-10, glibc-2.2.2-10, crontabs-1.9-2, slang-devel-1.4.2-2, libmng-1.0.0-2, audiofile-
0.1.11-1, findutils-4.1.6-2, automake-1.4-8, docbook-style-dsssl-1.59-10, apmd-3.0final-29, shadow-
utils-20000826-4, rdate-1.0-7, gcc-objc-2.96-81, zlib-devel-1.1.3-22, xinitrc-3.6-1, traceroute-1.4a5-
25, dev-3.1.0-14, ncompress-4.2.4-21, krb5-workstation-1.2.2-4, portmap-4.0-35, ksymoops-2.4.0-3,
nss_ldap-149-1, gv-3.5.8-11, xpdf-0.92-3, pciutils-2.1.8-19, mkinitrd-3.0.10-1, console-tools-
19990829-34, libgtop-devel-1.0.10-3, XFree86-devel-4.0.3-5, xloadimage-4.1-16, a2ps-4.13b-13,
syslinux-1.52-1, netpbm-devel-9.9-5, shapcfcg-2.2.12-5, ghostscript-5.50-17, XFree86-4.0.3-5, XFree86-
xfs-4.0.3-5, nessus-common-1.0.8-1
==== Recommended installs ====
==== End recommended packages ====

```



Package summary test:

Pass: Numerous package updates are moot, since these services are not running, but openssl-devel (2001-07-13), man (2001-09-06), xinetd (2001-09-07), util-linux (2001-10-06), kernel (2001-10-19), sendmail-cf (2001-10-22), ucd-snmp-devel (2001-10-31), kernel (2001-11-02), and openssh-askpass (2001-11-30) all have potential security impacts, and should all be installed. Remedy - download and install these immediately.

Bootable disk -- Pass: Bootable disk exists, floppy 1.44M

Incident handling disk -- Not pass: No incident handling disk exists

/etc/passwd is as follows:

```
root:x:0:0:root:/root:/bin/bash
bin:x:1:1:bin:/bin:
daemon:x:2:2:daemon:/sbin:
adm:x:3:4:adm:/var/adm:
gdm:x:42:42:./home/gdm:/bin/bash
xfs:x:43:43:X Font Server:/etc/X11/fs:/bin/false
nobody:x:99:99:Nobody:
deaves:x:500:100:David Eaves:/home/deaves:/bin/bash
```

Not pass: User Nobody is unneeded, as no web server is present, and it has home directory of root "/". Remove this user.

Passwords are not MD5 hashed, another hashing mechanism is in use.  
Pass: It works, and appears to be the standard Unix secure mechanism for one-way encryption.

/etc/shadow not shown here. Every user has a password entry in that file, and every user corresponds to a user defined in /etc/passwd, and vice versa.

Pass: all users have passwords

Every user has a shadowed password, and no other problems:

```
> pwck
user adm: directory /var/adm does not exist
user gdm: directory /home/gdm does not exist
user nobody: directory does not exist
pwck: no changes
```

Not pass: home directories for users adm and gdm, (adm is unnecessary and should be removed) (gdm provides assistance for the Linux Xwindows desktop environment, GNOME) are described, but do not exist. They are not necessary in either case for proper functioning of those services.

Password aging and nontrivial password as policy compliance.  
> chage deaves

Changing the aging information for deaves  
Enter the new value, or press return for the default

```
Minimum Password Age [0]:
Maximum Password Age [99999]:
Last Password Change (YYYY-MM-DD) [2001-10-22]:
Password Expiration Warning [7]:
Password Inactive [-1]:
Account Expiration Date (YYYY-MM-DD) [1969-12-31]:
```

Not pass: The policy may be observed, but it is neither tracked nor enforced. All passwords are nontrivial, partial pass.



No antivirus software installed -- Not pass. Purchase McAfee for Linux or PC-cillin

No shared or mounted filesystems:

```
> cat /etc/exp*
> exportfs
> df -k
Filesystem            1k-blocks      Used Available Use% Mounted on
/dev/hda1              248895        62917   173128   27% /
/dev/hda9             8901756      503904   7945624    6% /home
/dev/hda8             1011928        240    960284    1% /tmp
/dev/hda5             5044156      919440   3868484   20% /usr
/dev/hda6             2016016       17064   1896540    1% /var
>
```

Pass:

No setuid or setgid files that are not necessary:

```
find / \( -perm -4000 -perm -2000 \) -print
/usr/sbin/userhelper
find: /proc/3751/fd/4: No such file or directory
/etc/rc.d/init.d/boot
```

Not pass: Why is /etc/init.d/boot setuid? It need not be.  
/usr/sbin/userhelper should remain setuid -- Level of risk to be investigated. Remove setuid and move boot script functions to start pump and eth0 interface to earlier before Xwindows is started as a non-privileged user.

Linux loader (LILO) is password protected, and lilo.conf is invisible to nonprivileged users

Not pass: No password is set, and /etc/lilo.conf is world readable.  
Set this password to a new password, and make it 600

```
CTRL-ALT-DEL reboot from console is disabled
> cat /etc/inittab | grep shutdown
ca::ctrlaltdel:/sbin/shutdown -t3 -r now
# of power left. Schedule a shutdown for 2 minutes from now.
pf::powerfail:/sbin/shutdown -f -h +2 "Power Failure; System Shutting Down"
# If power was restored before the shutdown kicked in, cancel it.
pr:12345:powerokwait:/sbin/shutdown -c "Power Restored; Shutdown Cancelled"
```

Not pass: it appears to be defined for normal shutdown  
see man inittab. Comment out this line from inittab.

Single user mode boot requires root password

Not pass: No notation in /etc/inittab to restrict runlevel 1 to only root user, However inittab is root owned and default runlevel cannot be changed without changing it. Impact - low.

All console logins are disabled except for root and deaves:

Not pass: Users not disabled are bin, daemon, adm, gdm, xfs, and nobody. Pedantic, low risk.

TCP wrappers are in use:

```
> cat /etc/rc.iptables
iptables -N tcpin
iptables -N udpin
iptables -N ip-unknown
iptables -A INPUT -p all -s 127.0.0.0 -d 0.255.255.255 -j LOG --log-level info
```

```

iptables -A INPUT -p all -s 127.0.0.0 -d 0.255.255.255 -j DROP
iptables -A INPUT -p all -s 192.168.0.0 -d 0.0.255.255 -j LOG --log-level info
iptables -A INPUT -p all -s 192.168.0.0 -d 0.0.255.255 -j DROP
iptables -A INPUT -p all -s 172.16.0.0 -d 0.15.255.255 -j LOG --log-level info
iptables -A INPUT -p all -s 172.16.0.0 -d 0.15.255.255 -j DROP
# Stop all reverse-web-client SYN-ACK and ACK-RST scanning
iptables -A INPUT -p tcp --source-port 80 -m state --state INVALID,NEW -j LOG --log-level
info
iptables -A INPUT -p tcp --source-port 80 -m state --state INVALID,NEW -j DROP
iptables -A INPUT -p all -s 0.255.255.255/8 -j LOG --log-level info
iptables -A INPUT -p all -s 0.255.255.255/8 -j DROP
iptables -A INPUT -p icmp -s <DMZ LAN address> -d <DMZ LAN address> --icmp-type echo-
request -j ACCEPT
iptables -A INPUT -p icmp -d <DMZ LAN address> --icmp-type echo-reply -j ACCEPT
iptables -A INPUT -p icmp -d <DMZ LAN address> --icmp-type destination-unreachable -j
ACCEPT
iptables -A INPUT -p icmp -d <DMZ LAN address> --icmp-type time-exceeded -j ACCEPT
iptables -A INPUT -p icmp -d localhost --icmp-type echo-reply -j ACCEPT
iptables -A INPUT -p icmp -d localhost --icmp-type destination-unreachable -j ACCEPT
iptables -A INPUT -p icmp -d localhost --icmp-type time-exceeded -j ACCEPT
iptables -A INPUT -p icmp -j LOG --log-level info
iptables -A INPUT -p icmp -j DROP
iptables -A INPUT -p tcp -j tcpin
iptables -A INPUT -p udp -j udpin
iptables -A INPUT -j ip-unknown
iptables -P FORWARD DROP
# To prevent spoofing our addresses to incriminate us...
iptables -A OUTPUT -p tcp --destination-port 80 -s <DMZ LAN address> --tcp-flags
SYN,ACK,PSH,FIN,RST SYN -j ACCEPT
iptables -A OUTPUT -p tcp --destination-port 80 -s <DMZ LAN address> -m state --state
ESTABLISHED -j ACCEPT
iptables -A OUTPUT -p tcp --destination-port 80 -s <DMZ LAN address> --tcp-flags
SYN,ACK,PSH,FIN,RST FIN,ACK,PSH -j ACCEPT
iptables -A OUTPUT -p tcp --destination-port 80 -j LOG --log-level info
iptables -A OUTPUT -p tcp --destination-port 80 -j DROP
# inbound TCP rules
# all local-to-local only nessus traffic
iptables -A tcpin -p tcp -s localhost --source-port 1241 -d localhost -j ACCEPT
iptables -A tcpin -p tcp -s localhost --destination-port 1241 -d localhost -j ACCEPT
# all local-to-local only Xwindows traffic
# DANGER!! -- if this chain gets flushed, these go first, freezing Xwindows.
# You MUST append these rules to the end of the chain before flushing it.
iptables -A tcpin -p tcp -s localhost --source-port 6000 -d localhost -j ACCEPT
iptables -A tcpin -p tcp -s localhost --destination-port 6000 -d localhost -j ACCEPT
# all local-to-local only HTTP traffic
iptables -A tcpin -p tcp -s localhost --source-port 80 -d localhost -j ACCEPT
iptables -A tcpin -p tcp -s localhost --destination-port 80 -d localhost -j ACCEPT
# inbound HTTP responses from anywhere, but only for established locally
#iptables -A tcpin -p tcp --source-port 80 -d <DMZ LAN address> --tcp-flags
SYN,ACK,PSH,FIN,RST SYN,ACK -j ACCEPT
iptables -A tcpin -p tcp --source-port 80 -d <DMZ LAN address> -m state --state
ESTABLISHED -j ACCEPT
# inbound FTP responses from anywhere, but only for established locally
#iptables -A tcpin -p tcp --source-port 20 -d <DMZ LAN address> --tcp-flags
SYN,ACK,PSH,FIN,RST SYN,ACK -j ACCEPT
iptables -A tcpin -p tcp --source-port 20 -d <DMZ LAN address> -m state --state
ESTABLISHED -j ACCEPT
#iptables -A tcpin -p tcp --source-port 21 -d <DMZ LAN address> --tcp-flags
SYN,ACK,FIN,RST SYN,ACK -j ACCEPT
iptables -A tcpin -p tcp --source-port 21 -d <DMZ LAN address> -m state --state
ESTABLISHED -j ACCEPT
# inbound SMTP responses only from <remote system #2>, and only established locally
#iptables -A tcpin -p tcp -s 192.86.83.250 --source-port 25 -d <DMZ LAN address> --tcp-
flags SYN,ACK,PSH,FIN,RST SYN,ACK -j ACCEPT
iptables -A tcpin -p tcp -s 192.86.83.250 --source-port 25 -d <DMZ LAN address> -m state
--state ESTABLISHED -j ACCEPT
# inbound IMAP responses only from <remote system #2>, and only established locally
#iptables -A tcpin -p tcp -s 192.86.83.250 --source-port 143 -d <DMZ LAN address> --tcp-
flags SYN,ACK,PSH,FIN,RST SYN,ACK -j ACCEPT
iptables -A tcpin -p tcp -s 192.86.83.250 --source-port 143 -d <DMZ LAN address> -m state
--state ESTABLISHED -j ACCEPT

```

```

# inbound SSH responses only from <remote system #1>, and only established locally
#iptables -A tcpin -p tcp -s 192.86.83.nnn --source-port 22 -d <DMZ LAN address> --tcp-
flags SYN,ACK,PSH,FIN,RST SYN,ACK -j ACCEPT
iptables -A tcpin -p tcp -s 192.86.83.nnn --source-port 22 -d <DMZ LAN address> -m state
--state ESTABLISHED -j ACCEPT
# inbound whois responses only from whois.arin.net, and only established locally
#iptables -A tcpin -p tcp -s 192.149.252.21 --source-port 43 -d <DMZ LAN address> --tcp-
flags SYN,ACK,PSH,FIN,RST SYN,ACK -j ACCEPT
iptables -A tcpin -p tcp -s 192.149.252.0/26 --source-port 43 -d <DMZ LAN address> -m
state --state ESTABLISHED -j ACCEPT
# don't bother to log incoming http requests, it's all just code red and nimda vectors
iptables -A tcpin -p tcp -d <DMZ LAN address> --destination-port 80 -j DROP
# don't bother to log incoming security scans from AT&T Broadband authorized security
iptables -A tcpin -p tcp -s 24.0.0.203 --destination-port 119 -j DROP
iptables -A tcpin -p tcp -j LOG --log-level info
iptables -A tcpin -p tcp -j DROP
# Lesson learned!! -- when flushed, this chain freezes XWindows -- append these first
#iptables -A tcpin -p tcp ! -s localhost ! --source-port 6000 ! -d localhost -j DROP
#iptables -A tcpin -p tcp ! -s localhost ! --destination-port 6000 ! -d localhost -j DROP
# inbound UDP rules
# all DNS response traffic from the two designated name servers
#iptables -A udpin -p udp -s 24.5.207.179 --source-port 53 -d <DMZ LAN address> -j ACCEPT
iptables -A udpin -p udp -s 192.86.83.250 --source-port 53 -d <DMZ LAN address> -j ACCEPT
iptables -A udpin -p udp -s 216.148.227.68 --source-port 53 -d <DMZ LAN address> -j
ACCEPT
# drop without logging all other local SNMP
iptables -A udpin -p udp -s 192.168.1.0/24 --destination-port 161 -j DROP
iptables -A udpin -p udp -s 192.168.1.0/24 --destination-port 162 -j DROP
# don't log the usual dog-in-heat group-sex broadcasts from Windows
iptables -A udpin -p udp -s 192.168.1.0/24 -d 192.168.1.0/24 --destination-port 138 -j
DROP
# log all the remaining udp toxic waste
iptables -A udpin -p udp -j LOG --log-level info
iptables -A udpin -p udp -j DROP
# inbound IGMP and other IP-type packets
# drop network local IGMP without logging it
iptables -A ip-unknown -p igmp -s 192.168.100.1 -j DROP
# log all the strangest packets that fail other rules, before dropping them
iptables -A ip-unknown -j LOG --log-level info
iptables -A ip-unknown -j DROP

```

Pass: The DMZ LAN address has been edited out for public exposure.  
 Some FTP ACCEPT rules could be consolidated, and some of the SNMP DROP  
 rules -- low priority. Impact is router efficiency.  
 IPTables is installed and running effectively as a firewall

Remote telnet users are disallowed:

Pass: /etc/securetty has not been cut down to a minimum, but no  
 telnet services are running

Only permitted ports are unfiltered, as seen from the inside, esp. rpc:

```
> nmap -I -O -P0 -sR 192.168.1.3
```

```

Starting nmap V. 2.53 by fyodor@insecure.org ( www.insecure.org/nmap/ )
Warning: No TCP ports found open on this machine, OS detection will be MUCH less
reliable
All 1523 scanned ports on <DMZ LAN address> (192.168.1.3) are: filtered
Too many fingerprints match this host for me to give an accurate OS guess
Nmap run completed -- 1 IP address (1 host up) scanned in 1883 seconds

```

Pass:

Only permitted services running, as seen from from the inside

```
> netstat -at
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address           Foreign Address          State
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address           Foreign Address          State
tcp        0      0 *:x11                   *:                        LISTEN
tcp        0      0 localhost.localdoma:x11 localhost.localdom:1031  ESTABLISHED
tcp        0      0 localhost.localdoma:x11 localhost.localdom:1046  ESTABLISHED
tcp        0      0 localhost.localdoma:x11 localhost.localdom:1045  ESTABLISHED
tcp        0      0 localhost.localdoma:x11 localhost.localdom:1028  ESTABLISHED
tcp        0    32 localhost.localdoma:x11 localhost.localdom:1044  ESTABLISHED
tcp        0      0 localhost.localdoma:x11 localhost.localdom:1027  ESTABLISHED
tcp        0      0 localhost.localdom:1027 localhost.localdoma:x11  ESTABLISHED
tcp        0      0 localhost.localdom:1031 localhost.localdoma:x11  ESTABLISHED
tcp        0      0 localhost.localdom:1028 localhost.localdoma:x11  ESTABLISHED
tcp        0      0 localhost.localdom:1039 localhost.localdoma:x11  ESTABLISHED
tcp        0      0 localhost.localdom:1037 localhost.localdoma:x11  ESTABLISHED
tcp        0      0 localhost.localdom:1036 localhost.localdoma:x11  ESTABLISHED
tcp        0      0 localhost.localdoma:x11 localhost.localdom:1043  ESTABLISHED
tcp        0      0 localhost.localdom:1043 localhost.localdoma:x11  ESTABLISHED
tcp        0      0 localhost.localdom:1041 localhost.localdoma:x11  ESTABLISHED
tcp        0      0 localhost.localdom:1040 localhost.localdoma:x11  ESTABLISHE
tcp        0      0 localhost.localdom:1046 localhost.localdoma:x11  ESTABLISHED
tcp        0      0 localhost.localdom:1045 localhost.localdoma:x11  ESTABLISHED
tcp        0    132 localhost.localdom:1044 localhost.localdoma:x11  ESTABLISHED
tcp        0      0 localhost.localdom:1048 localhost.localdoma:x11  ESTABLISHED
tcp        0      0 localhost.localdoma:x11 localhost.localdom:1041  ESTABLISHED
tcp        0      0 localhost.localdoma:x11 localhost.localdom:1040  ESTABLISHED
tcp        0      0 localhost.localdoma:x11 localhost.localdom:1039  ESTABLISHED
tcp        0      0 localhost.localdoma:x11 localhost.localdom:1037  ESTABLISHED
tcp        0      0 localhost.localdoma:x11 localhost.localdom:1036  ESTABLISHED
tcp        0      0 localhost.localdoma:x11 localhost.localdom:1048  ESTABLISHED
```

Pass: the only service running is the X11 server, on port 6000, although it has numerous sessions open (xterm instances).

No unusual or suspicious file descriptors are seen using lsof:

```
> lsof -l +M
```

```
COMMAND  PID  USER  FD  TYPE  DEVICE  SIZE  NODE  NAME
X        659  root   1u  IPv4  970          TCP *:x11 (LISTEN)
X        659  root  11u  IPv4  1285          TCP localhost.localdomain:x11-
>localhost.localdomain:1027 (ESTABLISHED)
X        659  root  12u  IPv4  1296          TCP localhost.localdomain:x11-
>localhost.localdomain:1028 (ESTABLISHED)
X        659  root  13u  IPv4  1402          TCP localhost.localdomain:x11-
>localhost.localdomain:1036 (ESTABLISHED)
X        659  root  14u  IPv4  1408          TCP localhost.localdomain:x11-
>localhost.localdomain:1037 (ESTABLISHED)
X        659  root  15u  IPv4  1322          TCP localhost.localdomain:x11-
>localhost.localdomain:1031 (ESTABLISHED)
X        659  root  16u  IPv4  1423          TCP localhost.localdomain:x11-
>localhost.localdomain:1039 (ESTABLISHED)
X        659  root  17u  IPv4  1514          TCP localhost.localdomain:x11-
>localhost.localdomain:1040 (ESTABLISHED)
X        659  root  18u  IPv4  1528          TCP localhost.localdomain:x11-
>localhost.localdomain:1041 (ESTABLISHED)
X        659  root  20u  IPv4  1556          TCP localhost.localdomain:x11-
>localhost.localdomain:1043 (ESTABLISHED)
X        659  root  21u  IPv4  1561          TCP localhost.localdomain:x11-
>localhost.localdomain:1044 (ESTABLISHED)
X        659  root  22u  IPv4  1564          TCP localhost.localdomain:x11-
>localhost.localdomain:1045 (ESTABLISHED)
X        659  root  23u  IPv4  1568          TCP localhost.localdomain:x11-
>localhost.localdomain:1046 (ESTABLISHED)
X        659  root  24u  IPv4  1864          TCP localhost.localdomain:x11-
>localhost.localdomain:1048 (ESTABLISHED)
```

```

gnome-ses 687 deaves 4u IPv4 1283 TCP localhost.localdomain:1027-
>localhost.localdomain:x11 (ESTABLISHED)
gnome-smp 759 deaves 3u IPv4 1294 TCP localhost.localdomain:1028-
>localhost.localdomain:x11 (ESTABLISHED)
magicdev 761 deaves 3u IPv4 1320 TCP localhost.localdomain:1031-
>localhost.localdomain:x11 (ESTABLISHED)
sawfish 774 deaves 3u IPv4 1406 TCP localhost.localdomain:1037-
>localhost.localdomain:x11 (ESTABLISHED)
xscreensa 779 deaves 3u IPv4 1400 TCP localhost.localdomain:1036-
>localhost.localdomain:x11 (ESTABLISHED)
gnome-nam 787 deaves 3u IPv4 1421 TCP localhost.localdomain:1039-
>localhost.localdomain:x11 (ESTABLISHED)
gmc 795 deaves 3u IPv4 1526 TCP localhost.localdomain:1041-
>localhost.localdomain:x11 (ESTABLISHED)
panel 797 deaves 3u IPv4 1512 TCP localhost.localdomain:1040-
>localhost.localdomain:x11 (ESTABLISHED)
gnome-ter 801 deaves 3u IPv4 1554 TCP localhost.localdomain:1043-
>localhost.localdomain:x11 (ESTABLISHED)
gnome-ter 803 deaves 3u IPv4 1559 TCP localhost.localdomain:1044-
>localhost.localdomain:x11 (ESTABLISHED)
gnome-ter 805 deaves 3u IPv4 1562 TCP localhost.localdomain:1045-
>localhost.localdomain:x11 (ESTABLISHED)
gnome-ter 807 deaves 3u IPv4 1566 TCP localhost.localdomain:1046-
>localhost.localdomain:x11 (ESTABLISHED)
tasklist_ 855 deaves 3u IPv4 1862 TCP localhost.localdomain:1048-
>localhost.localdomain:x11 (ESTABLISHED)

```

Pass: The only known inet file descriptors are for the X11 service, to support the windowing activity of the Xwindows/GNOME applications.

No .rhosts or hosts.equiv anywhere on the system:

Pass: No return from either find / -name .rhosts -ls or find / -name hosts.equiv -ls

```

> which tripwire
/usr/sbin/tripwire
> tripwire -m c
### Error: File could not be opened.
### Filename: /var/lib/tripwire/hostname.domainname.twd
### No such file or directory
### Exiting...

```

Pass: If tripwire had not been initialized it would have showed something like the following:

```

### Error: File could not be opened.
### Filename: /etc/tripwire/tw.cfg
### No such file or directory
### Configuration file could not be read.
### Exiting...

```

or

Use --help to get help.

Sendmail has a secure sendmail.cf:

```

O PrivacyOptions=authwarnings,novrfy,noexpn,restrictqrun
and
no DAEMON except "DnMAILER-DAEMON", "DAEMON=no" inserted

```

Pass:

Physical Premises:

Not pass: Only the screensaver times out: the console is not secured.

Not pass: There is no safe, the passwords are not physically secured.

Pass: The premises are locked at all times when personnel are absent.

Pass: The router is physically disconnected during prolonged absences.

Configure Xwindows to time out with inactivity of 15 minutes. Purchase a safe, put the passwords and other documents inside it.

UPS and backups are functioning

Not pass: No UPS, backups are monthly

Appropriate privileged users root, bin, daemon, gdm, and xfs are present and have passwords:

Pass: see /etc/passwd, listed above

Groups are limited to only necessary ones, and all have passwords:

```
root:x:0:root
bin:x:1:root,bin,daemon
daemon:x:2:root,bin,daemon
sys:x:3:root,bin,adm
adm:x:4:root,adm,daemon
tty:x:5:
disk:x:6:root
mem:x:8:
kmem:x:9:
wheel:x:10:root
nobody:x:99:
users:x:100:
utmp:x:22:
gdm:x:42:
xfs:x:43:
```

Pass: adm might be eliminated, or could be required for some system services on startup. Others can be tested for by rebooting, eliminating groups, and seeing if any required system services are impaired or prevented from startup. Other groups than this can all be safely removed without impairing normal workstation functioning.

From experience, bin and daemon are used for system daemons and services, sys, mem, and kmem are used by system internals and devices, disk, wheel, and tty are used for peripherals and devices, utmp for logging, gdm and xfs for Xwindows/GNOME, and adm for -- not sure...

/etc/gshadow indicates all groups have nontrivial passwords

IPtables is running and configured appropriately:

```
> iptables -L --line-number -n <annotated by author>
```

Chain INPUT (policy ACCEPT)

num	target	prot	opt	source	destination	
# Note: source routing and malformed packets logged and dropped						
1	LOG	all	--	127.0.0.0	0.255.255.255	LOG flags 0 level 6
2	DROP	all	--	127.0.0.0	0.255.255.255	
3	LOG	all	--	192.168.0.0	0.0.255.255	LOG flags 0 level 6
4	DROP	all	--	192.168.0.0	0.0.255.255	
5	LOG	all	--	172.16.0.0	0.15.255.255	LOG flags 0 level 6
6	DROP	all	--	172.16.0.0	0.15.255.255	
7	LOG	tcp	--	0.0.0.0/0	0.0.0.0/0	tcp spt:80 state
INVALID,NEW LOG flags 0 level 6						
8	DROP	tcp	--	0.0.0.0/0	0.0.0.0/0	tcp spt:80 state
INVALID,NEW						
9	LOG	all	--	0.0.0.0/8	0.0.0.0/0	LOG flags 0 level 6
10	DROP	all	--	0.0.0.0/8	0.0.0.0/0	

```

# Note ICMP returning from pings and traceroutes accepted, all other is dropped
11 ACCEPT icmp -- 192.168.1.3 192.168.1.3 icmp type 8
12 ACCEPT icmp -- 0.0.0.0/0 192.168.1.3 icmp type 0
13 ACCEPT icmp -- 0.0.0.0/0 192.168.1.3 icmp type 3
14 ACCEPT icmp -- 0.0.0.0/0 192.168.1.3 icmp type 11
15 ACCEPT icmp -- 0.0.0.0/0 127.0.0.1 icmp type 0
16 ACCEPT icmp -- 0.0.0.0/0 127.0.0.1 icmp type 3
17 ACCEPT icmp -- 0.0.0.0/0 127.0.0.1 icmp type 11
18 LOG icmp -- 0.0.0.0/0 0.0.0.0/0 LOG flags 0 level 6
19 DROP icmp -- 0.0.0.0/0 0.0.0.0/0
# Note and the tcp, udp, and other gets split up to different rulesets
20 tcpin tcp -- 0.0.0.0/0 0.0.0.0/0
21 udpin udp -- 0.0.0.0/0 0.0.0.0/0
22 ip-unknown all -- 0.0.0.0/0 0.0.0.0/0

# Note -- all forwarding is turned off
Chain FORWARD (policy DROP)
num target prot opt source destination

Chain OUTPUT (policy ACCEPT)
num target prot opt source destination
# Note -- all invalid or other nonestablished http outbound is stopped in case
# the next HTTP worm gets by us. Done by passing all valid, logging/dropping
# the rest.
1 ACCEPT tcp -- 192.168.1.3 0.0.0.0/0 tcp dpt:80
flags:0x021F/0x022
2 ACCEPT tcp -- 192.168.1.3 0.0.0.0/0 tcp dpt:80 state
ESTABLISHED
3 ACCEPT tcp -- 192.168.1.3 0.0.0.0/0 tcp dpt:80
flags:0x021F/0x0219
4 LOG tcp -- 0.0.0.0/0 0.0.0.0/0 tcp dpt:80 LOG flags 0
level 6
5 DROP tcp -- 0.0.0.0/0 0.0.0.0/0 tcp dpt:80

Chain ip-unknown (1 references)
num target prot opt source destination
# Note don't clutter the logs with the Windows multicast noise
1 DROP 2 -- 192.168.100.1 0.0.0.0/0
2 LOG all -- 0.0.0.0/0 0.0.0.0/0 LOG flags 0 level 6
3 DROP all -- 0.0.0.0/0 0.0.0.0/0

Chain tcpin (1 references)
num target prot opt source destination
# Note -- let through sepcifically allowed IP, log and drop the rest
# All localhost Nessus, HTTP, Xwindows traffic
1 ACCEPT tcp -- 127.0.0.1 127.0.0.1 tcp spt:1241
2 ACCEPT tcp -- 127.0.0.1 127.0.0.1 tcp dpt:1241
3 ACCEPT tcp -- 127.0.0.1 127.0.0.1 tcp spt:6000
4 ACCEPT tcp -- 127.0.0.1 127.0.0.1 tcp dpt:6000
5 ACCEPT tcp -- 127.0.0.1 127.0.0.1 tcp spt:80
6 ACCEPT tcp -- 127.0.0.1 127.0.0.1 tcp dpt:80
# All returning HTTP, FTP, SMTP, IMAP, SSH, and NICNAME service allowed
7 ACCEPT tcp -- 0.0.0.0/0 192.168.1.3 tcp spt:80 state
ESTABLISHED
8 ACCEPT tcp -- 0.0.0.0/0 192.168.1.3 tcp spt:20 state
ESTABLISHED
9 ACCEPT tcp -- 0.0.0.0/0 192.168.1.3 tcp spt:21 state
ESTABLISHED
10 ACCEPT tcp -- 192.86.83.nnn 192.168.1.3 tcp spt:25 state
ESTABLISHED
11 ACCEPT tcp -- 192.86.83.nnn 192.168.1.3 tcp spt:143 state
ESTABLISHED
12 ACCEPT tcp -- 192.86.83.mmm 192.168.1.3 tcp spt:22 state
ESTABLISHED
13 ACCEPT tcp -- 192.149.252.0/26 192.168.1.3 tcp spt:43 state
ESTABLISHED
# Don't clutter the logs with HTTP worm noise
14 DROP tcp -- 0.0.0.0/0 192.168.1.3 tcp dpt:80
# Don't clutter the logs with network "security" surveillance
15 DROP tcp -- 24.0.0.203 0.0.0.0/0 tcp dpt:119
16 LOG tcp -- 0.0.0.0/0 0.0.0.0/0 LOG flags 0 level 6

```

```
17 DROP tcp -- 0.0.0.0/0 0.0.0.0/0
```

Chain udpin (1 references)

```
num target prot opt source destination
# Note -- allow specific returning traffic, and log/drop all the rest
# DNS service returning from designated name servers
1 ACCEPT udp -- 192.86.83.nnn 192.168.1.3 udp spt:53
2 ACCEPT udp -- 216.148.227.68 192.168.1.3 udp spt:53
# Don't clutter the logs with SNMP, or NETBIOS/Browser broadcasts
3 DROP udp -- 192.168.1.0/24 0.0.0.0/0 udp dpt:161
4 DROP udp -- 192.168.1.0/24 0.0.0.0/0 udp dpt:162
5 DROP udp -- 192.168.1.0/24 192.168.1.255 udp dpt:138
6 LOG udp -- 0.0.0.0/0 0.0.0.0/0 LOG flags 0 level 6
7 DROP udp -- 0.0.0.0/0 0.0.0.0/0
```

Pass: IPTables is running correctly, as rc.iptables configured it. The -n numeric-only option was used here to obscure host names.

The logging appears to be functioning correctly:

```
> ls -al /var/log/*[A-z]
-rw----- 1 root root 43241 Dec 4 16:22 /var/log/boot.log
-rw----- 1 root root 35488 Dec 4 19:40 /var/log/cron
-rw-r--r-- 1 root root 5113 Dec 4 16:21 /var/log/dmesg
-rw-r--r-- 1 root root 146292 Dec 4 16:22 /var/log/lastlog
-rw----- 1 root root 1063 Dec 4 04:04 /var/log/maillog
-rw-r--r-- 1 root root 3972695 Dec 4 19:36 /var/log/messages
-rw----- 1 root root 497 Dec 4 16:19 /var/log/secure
-rw----- 1 root root 0 Dec 2 04:02 /var/log/spooler
-rw-r--r-- 1 root root 0 Mar 2 2001 /var/log/statistics
-rw-rw-r-- 1 root utmp 152448 Dec 4 16:22 /var/log/wtmp
-rw-r--r-- 1 deaves users 24441 Dec 4 18:48 /var/log/XFree86.0.log
```

and

```
> tail /var/log/messages
Dec 4 18:56:22 localhost kernel: IN=eth0 OUT=
MAC=00:50:ba:5a:7b:0f:00:04:5a:2a:94:e3:08:00 SRC=12.236.160.28 DST=192.168.1.3 LEN=48
TOS=0x00 PREC=0x00 TTL=123 ID=36415 DF PROTO=TCP SPT=3068 DPT=27374 WINDOW=8192 RES=0x00
SYN URGP=0
Dec 4 18:59:00 localhost kernel: IN=eth0 OUT=
MAC=ff:ff:ff:ff:ff:ff:00:e0:29:56:88:cd:08:00 SRC=192.168.1.2 DST=192.168.1.7 LEN=238
TOS=0x00 PREC=0x00 TTL=128 ID=26660 PROTO=UDP SPT=138 DPT=138 LEN=218
Dec 4 19:06:30 localhost kernel: IN=eth0 OUT= sys2
MAC=ff:ff:ff:ff:ff:ff:00:e0:29:56:88:cd:08:00 SRC=192.168.1.2 DST=192.168.1.7 LEN=261
TOS=0x00 PREC=0x00 TTL=128 ID=26916 PROTO=UDP SPT=138 DPT=138 LEN=241
Dec 4 19:06:33 localhost kernel: IN=lo OUT=
MAC=00:00:00:00:00:00:00:00:00:00:00:00:08:00 SRC=127.0.0.1 DST=127.0.0.1 LEN=84 TOS=0x00
PREC=0x00 TTL=64 ID=0 DF PROTO=UDP SPT=875 DPT=111 LEN=64
Dec 4 19:07:08 localhost last message repeated 7 times
Dec 4 19:07:28 localhost last message repeated 4 times
Dec 4 19:14:00 localhost kernel: IN=eth0 OUT=
MAC=ff:ff:ff:ff:ff:ff:00:e0:29:56:88:cd:08:00 SRC=192.168.1.2 DST=192.168.1.7 LEN=238
TOS=0x00 PREC=0x00 TTL=128 ID=27172 PROTO=UDP SPT=138 DPT=138 LEN=218
Dec 4 19:21:30 localhost kernel: IN=eth0 OUT=
MAC=ff:ff:ff:ff:ff:ff:00:e0:29:56:88:cd:08:00 SRC=192.168.1.2 DST=192.168.1.7 LEN=261
TOS=0x00 PREC=0x00 TTL=128 ID=27428 PROTO=UDP SPT=138 DPT=138 LEN=241
Dec 4 19:29:00 localhost kernel: IN=eth0 OUT=
MAC=ff:ff:ff:ff:ff:ff:00:e0:29:56:88:cd:08:00 SRC=192.168.1.2 DST=192.168.1.7 LEN=238
TOS=0x00 PREC=0x00 TTL=128 ID=27684 PROTO=UDP SPT=138 DPT=138 LEN=218
Dec 4 19:36:30 localhost kernel: IN=eth0 OUT=
MAC=ff:ff:ff:ff:ff:ff:00:e0:29:56:88:cd:08:00 SRC=192.168.1.2 DST=192.168.1.7 LEN=261
TOS=0x00 PREC=0x00 TTL=128 ID=27940 PROTO=UDP SPT=138 DPT=138 LEN=241
```

Pass: The logs reflect recent reboot events, and appear to show correct logging from iptables logging requirements. Iptables could have been directed to do userspace logging, or some alternative, and the eth0 interface appears to have an incorrect broadcast address, 192.168.1.7 for reasons unknown to the author at this time, probably related to the subnet mask of 248=(255-7). Impact from this is low.



Unusual events and known exploits logged/noted:

Pass: Personnel take enjoyment from mapping out sources of trouble, common (script-kiddie) intrusion attempts, surreptitious network surveillance such as upstairs-router compromise, sniffing, ARP or SNMP spoofing, and the like.

Filtering all requests from subnets 202-203, 210-211 (APNIC), and 68, and a few others can cut the number of serious intrusion attempts to a fractional amount, and in addition, drops requests from foreign sovereign regions that have few property or other legal conventions with the United States.

/etc/passwd, /etc/group, and /etc/shadow are root, 644, 600

```
> ls -al passwd group shadow
-rw-r--r-- 1 root root 225 Oct 23 19:16 group
-rw-r--r-- 1 root root 262 Dec 4 15:18 passwd
-rw----- 1 root root 475 Dec 4 15:20 shadow
```

Pass: rw- is a 6, r-- is a 4, and --- is a 0.

No users or groups are uid or gid of zero

Pass: See /etc/passwd and /etc/group shown earlier

No "." in any PATH environmental variable:

```
/usr/kerberos/bin:/usr/java/jdk1.3.1_01/bin:/usr/bin:/bin:/usr/X11R6/bin:/usr/local/bin:/
opt/bin:/home/deaves/bin:/home/deaves/jakarta-ant-1.4/bin
```

```
/usr/kerberos/bin:/bin:/usr/bin:/usr/local/bin:/usr/bin/X11:/usr/X11R6/bin
```

and

```
/usr/local/sbin:/usr/sbin:/sbin:/usr/kerberos/sbin:/usr/kerberos/bin:/bin:/sbin:/usr/bin:
/usr/sbin:/usr/local/bin:/usr/local/sbin:/usr/bin/X11:/usr/X11R6/bin:/root/bin
```

Pass: for the only users that support a login shell, from /etc/passwd, the PATH variables are listed above, deaves, gdm, and root. None of them has a "." entry.

No inappropriate files in /root:

```
> ls -al /root
total 7123
drwxr-x--- 9 root root 1024 Dec 4 20:08 .
drwxr-xr-x 18 root root 1024 Dec 4 16:21 ..
-rw----- 1 root root 20568 Dec 4 16:19 .bash_history
-rw-r--r-- 1 root root 24 Jun 10 2000 .bash_logout
-rw-r--r-- 1 root root 266 Jun 10 2000 .bash_profile
-rw-r--r-- 1 root root 176 Aug 23 1995 .bashrc
-rw-r--r-- 1 root root 210 Jun 10 2000 .cshrc
drwxr-xr-x 2 root root 1024 Oct 24 19:06 .ethereal
drwx----- 5 root root 1024 Oct 23 17:21 .gnome
drwxr-xr-x 3 root root 1024 Oct 23 17:10 .gnome-desktop
drwx----- 2 root root 1024 Oct 22 20:19 .gnome_private
-rw----- 1 root root 0 Oct 23 17:21 .ICEauthority
-rw----- 1 root root 7196900 Dec 3 11:25 mbox
drwxr-xr-x 2 root root 1024 Oct 23 17:21 .mc
-rw----- 1 root root 769 Oct 25 14:37 .nessus.keys
-rw----- 1 root root 21962 Dec 3 19:18 .nessusrc
drwxr-xr-x 3 root root 1024 Oct 23 17:10 .sawfish
-rw-r--r-- 1 root root 196 Jul 11 2000 .tcshrc
-rw-r--r-- 1 root root 32 Oct 22 19:08 .TWM-errors
-rw-r--r-- 1 root root 4 Oct 22 19:08 .wm_style
drwx----- 2 root 500 1024 Oct 22 17:40 .xauth
-rw----- 1 root users 66 Oct 23 17:47 .Xauthority
```

```
-rw-r--r-- 1 root root 1126 Aug 23 1995 .Xresources
```

Not pass: There are only bash, csh, ethereal, nessus, gnome, sawfish/ICE, and X related files needed here. It is not clear to the author at this time what exactly is .TWM-errors or .wm\_style, best guess is that it is a prior window manager used on RedHat reinstallation on or about October 22. Impact: low  
Remove these files.

User home directories and . files are all 755 or more restrictive:

```
> ls -al /home
total 37
drwxr-xr-x 7 root root 4096 Oct 22 10:35 .
drwxr-xr-x 18 root root 1024 Dec 4 16:21 ..
drwxr-xr-x 52 deaves users 4096 Dec 4 19:37 deaves
drwxr-xr-x 2 deaves users 16384 Jul 12 13:48 lost+found
drwxr-xr-x 6 deaves users 4096 Jul 30 15:00 redhat7.1
drwxr-xr-x 24 deaves users 4096 Aug 7 20:07 tempuser
```

Not pass: Remedial chmod -R go-w /home/deaves/\* /home/tempuser/\* and also chmod -R go-w /home/deaves/\* /home/tempuser/\* assures pass.

Summary of Remedies, in order of subjective estimate of cost/time, and triaged: Done in the course of, or immediately after the audit:

- 1) Remove users nobody, adm, remove /home/gdm from /etc/passwd
- 2) Remove .TWM-errors and .wm\_style from /root
- 3) Make user directories and all content 755 or better (go-w)
- 4) Disable CTRL-ALT-DEL reboot in inittab
- 5) Restrict users bin, daemon, gdm, and xfs in /etc/securetty
- 6) Purchase Linux Anti-virus software and install
- 7) Enforce password policy with respect to aging
- 8) Install RedHat packages listed above

Remedial actions to be taken:

- 9) Purchase a safe, put the passwords and other documents inside it.
- 10) Configure Xwindows to time out with inactivity of 15 minutes.
- 11) Investigate /usr/sbin/userhelper setuid requirement
- 12) Set LILO password and make /etc/lilo.conf root 600
- 13) Make an incident handling disk
- 14) Purchase a reliable UPS, change backup policy to weekly
- 15) Rearrange boot script for setuid, to start pump/eth0 before Xwindows

Lower priority:

- 16) Investigate how to restrict runlevel 1 to root user only

Final Audit for System #1 was conducted December 4, 2001, and no claim is made here for the condition of this system on any date after that.

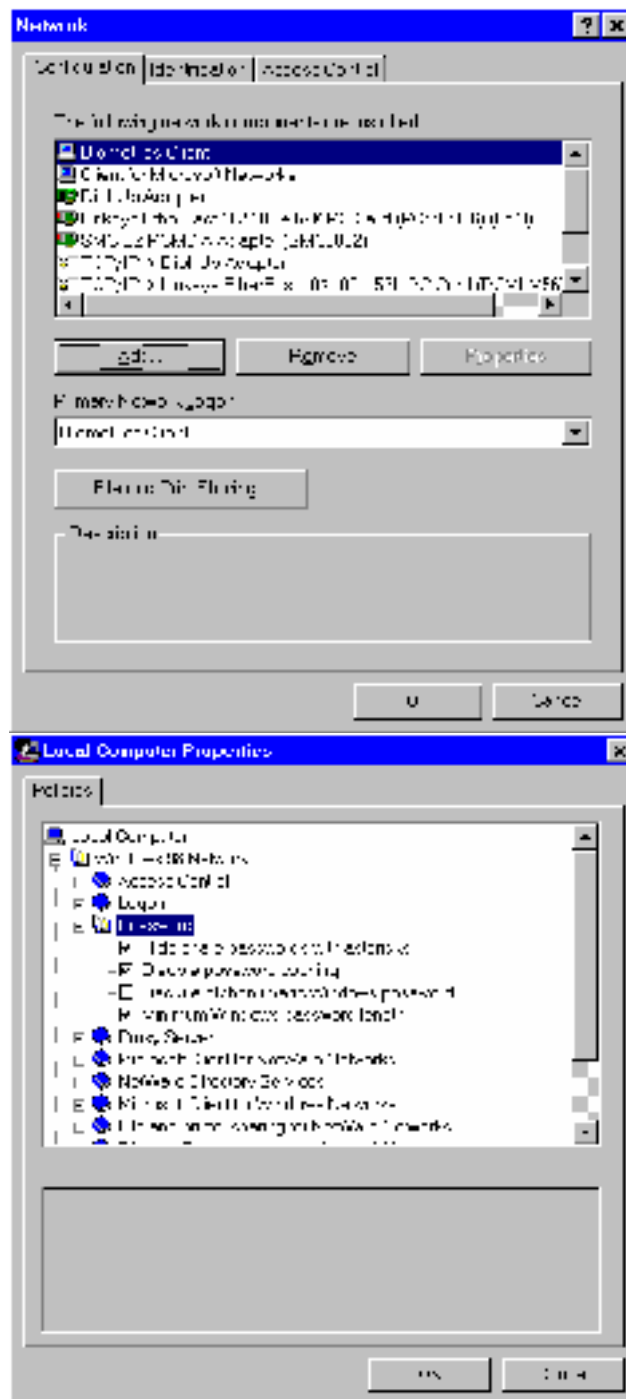
Supporting matrixes for risk mitigation analysis follow:

Failed checklist items represent risks of damage, times annual frequency/likelihood of a related exploit that could otherwise be prevented. These are subjective estimates provided by the management, whose assistance was invaluable in preparing this report.

	Passwords in a Safe: Premises intrusion	Xwindows times out: Premises intrusion	No setuid, setgid files: privilege escalation	LILO pw set: Premises intrusion	Incident disk: successful compromise	UPS: Power failure
System #1	0.5	0.5	0.1	0.5	0.5	0.5

Assumptions are that compromise via premises intrusion will degrade 100 percent of any exposed assets, unauthorized personnel do in fact access the premises on average once per month, with unknown technical abilities, an incident handling disk will mitigate this damage to the degree of about fifty percent of any damage done. A UPS has a fifty-fifty chance in a year of saving assets on any device attached to a faulty power source.

## Appendix B: Benchmark and Matrixes, System #2

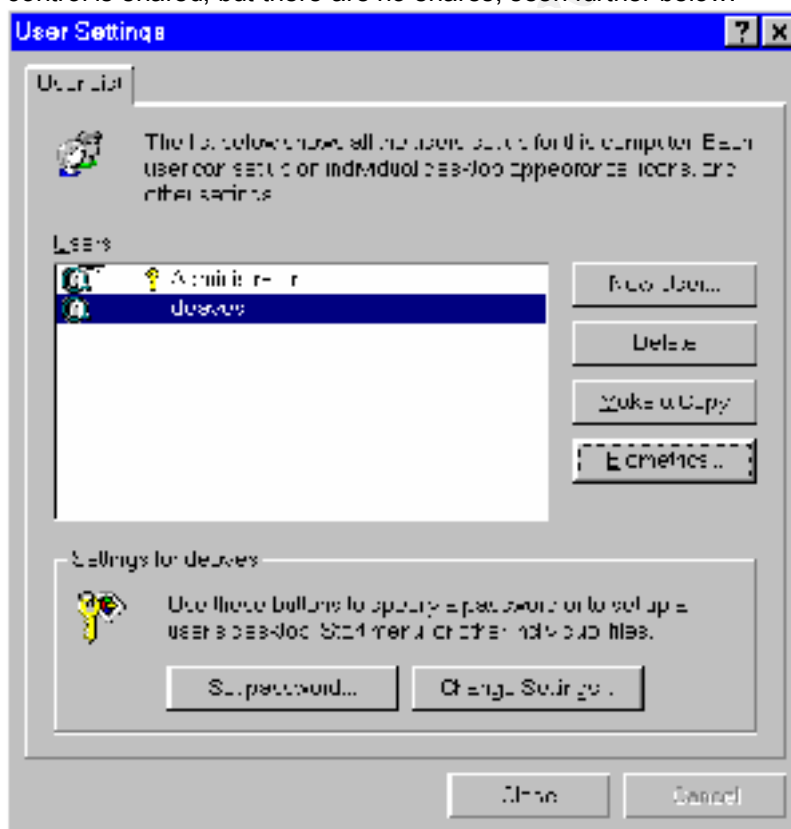


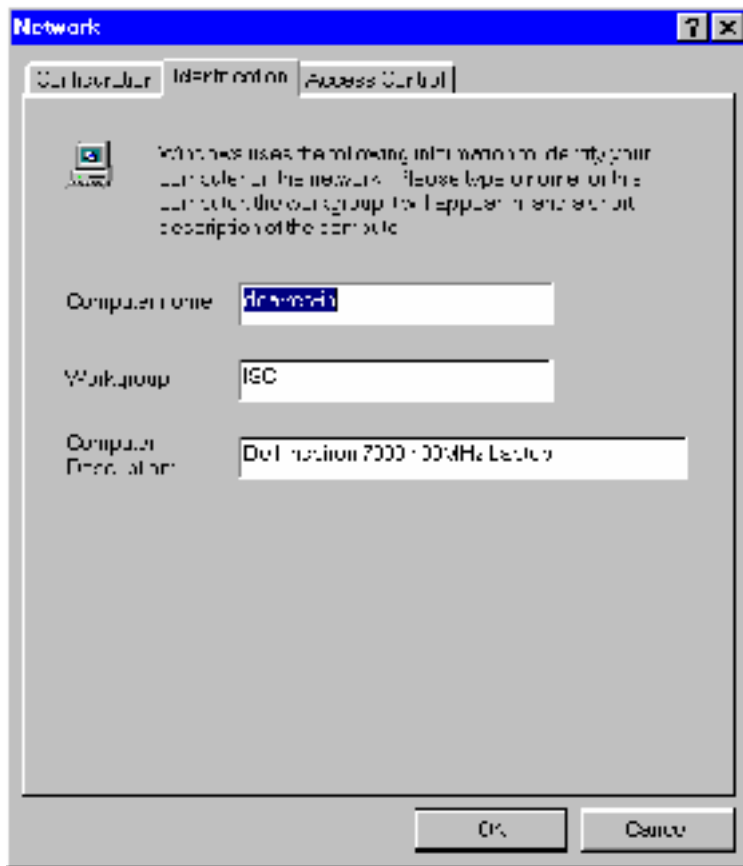
Pass: Using Settings, Network, and using poledit.exe, run from the Windows 98 install CD, from \tools\reskit\netadmin\poledit (Important – installation of this onto the machine represents a marginal security risk, however small – it is not installed here, but run from original media). The biometrics client login is specified, and using poledit.exe, select File, Open Registry, and double click Local Computer. In the properties panel, open Windows 98 Network properties, and examine the Password policy. It is correct here.

Note that the biometric logon client allows use of “fingerprint only” to log on to the system, as seen in the Control Panel, Users panel, clicking on the Biometric button inserted there as a result of the biometric client software for Windows 95/98 installed by the thumbprint reader PCMCIA card bought recently from [www.identix.com](http://www.identix.com) and installed on this system. This actually moots the password policy, although it is technically correct.



Pass: Windows is installed multiuser and has a proper workgroup, as shown below. Access control is shared, but there are no shares, seen further below.

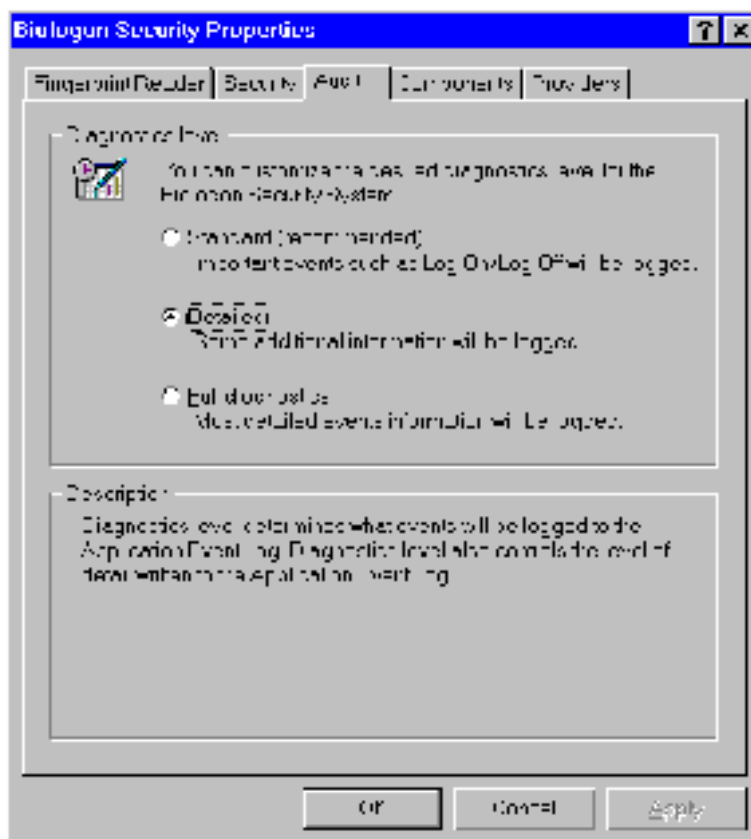




Not pass: System events are audited: logon, and account change, but not object access, access change, boot, or policy change. The first two are only audited because of a third party product, the biometric logon client, as shown below, launched from the Control Panel. The auditing policy for system events must be investigated for Windows 95/98 in order to correct this.

Accounts are locked out after more than 20 logon attempts:

Not pass: account lockouts are not configured for more than 20 logon attempts. This may not be corrected immediately, because, 1) how to do this must be investigated for Windows 95/98, and 2) the biometric logon process is set at a high security level, sometimes requiring as many as ten or more logon attempts to successfully log on.



System events are logged – Not pass: viewing c:\windows\SchedLog.txt as seen in notepad below indicates that the last time a system event was logged was two days prior, when a Windows update event occurred. The EventSystem application, built into Windows 98 appears to have never been in operation since 1999, and has apparently stopped functioning correctly as of the last critical Windows 98 security update.

There is no remedial action known that can be taken at this time. Searches for the COM Services package for Windows 98 has been futile to date, it appears not to be present on the Windows 98 install media, and C:\windows\esserver.exe appears not to function because it is missing a symbolic link in the DLL estier2.dll, which bears the timestamp of a 11/27/2001 Windows security update. Many esserver.exe DLL's bear the same timestamp. The [windowsupdate.microsoft.com](http://windowsupdate.microsoft.com) website claims that for the IE 5.5 security patch, there is no uninstall procedure, and hence no remedial action that can be taken, pending another patch from Microsoft.

Richard Ling Ltd - Notepad

File Edit Search Help

```

"Windows Critical Update Notification.job" (WUCRTUPD.EXE)
  Started 12/3/01 8:45:00 AM
"Windows Critical Update Notification.job" (WUCRTUPD.EXE)
  Finished 12/3/01 8:45:10 AM
  Result: The task completed with an exit code of (0).
"Windows Critical Update Notification.job" (WUCRTUPD.EXE)
  Started 12/3/01 8:50:00 AM
"Windows Critical Update Notification.job" (WUCRTUPD.EXE)
  Finished 12/3/01 8:50:10 AM
  Result: The task completed with an exit code of (0).
"Windows Critical Update Notification.job" (WUCRTUPD.EXE)
  Started 12/3/01 8:55:00 AM
"Windows Critical Update Notification.job" (WUCRTUPD.EXE)
  Finished 12/3/01 8:55:10 AM
  Result: The task completed with an exit code of (0).
"Windows Critical Update Notification.job" (WUCRTUPD.EXE)
  Started 12/3/01 9:00:00 AM
"Windows Critical Update Notification.job" (WUCRTUPD.EXE)
  Finished 12/3/01 9:00:10 AM
  Result: The task completed with an exit code of (0).
"Windows Critical Update Notification.job" (WUCRTUPD.EXE)
  Started 12/3/01 9:05:00 AM
"Windows Critical Update Notification.job" (WUCRTUPD.EXE)

```

Microsoft Internet Explorer

File Edit View Stop Back Forward Home Stop Search Favorites View Favorites Tools Help

Address <http://www.microsoft.com/...>

Type	Date	Time	Category	Event	Description	Source
Warning	6/24/1999	7:20:17 AM	Local System	0x00000000	The COM+ Event System could not determine the name of the current user. A call to CoGetUserName returned error code 1245: "The operation being requested was not performed because the user has not logged on to the network. The specified service does not exist."	COM+
Warning	6/24/1999	7:20:18 AM	Event System	0x00000000	The COM+ Event System could not determine the name of the current user. A call to CoGetUserName returned error code 1245: "The operation being requested was not performed because the user has not logged on to the network. The specified service does not exist."	COM+
Warning	6/24/1999	7:20:19 AM	Event System	0x00000000	The COM+ Event System could not determine the name of the current user. A call to CoGetUserName returned error code 1245: "The operation being requested was not performed because the user has not logged on to the network. The specified service does not exist."	COM+
Warning	6/24/1999	7:20:21 AM	Event System	0x00000000	The COM+ Event System could not determine the name of the current user. A call to CoGetUserName returned error code 1245: "The operation being requested was not performed because the user has not logged on to the network. The specified service does not exist."	COM+
Error	7/17/2001	13:53:55	Event System	0x00000000	The COM+ Event System detected a bad return code during its internal processing. HRESULT: 0x80000000 from line 39 of C:\inf\event\event.sys. Please contact Microsoft Product Support Services to report this error.	COM+



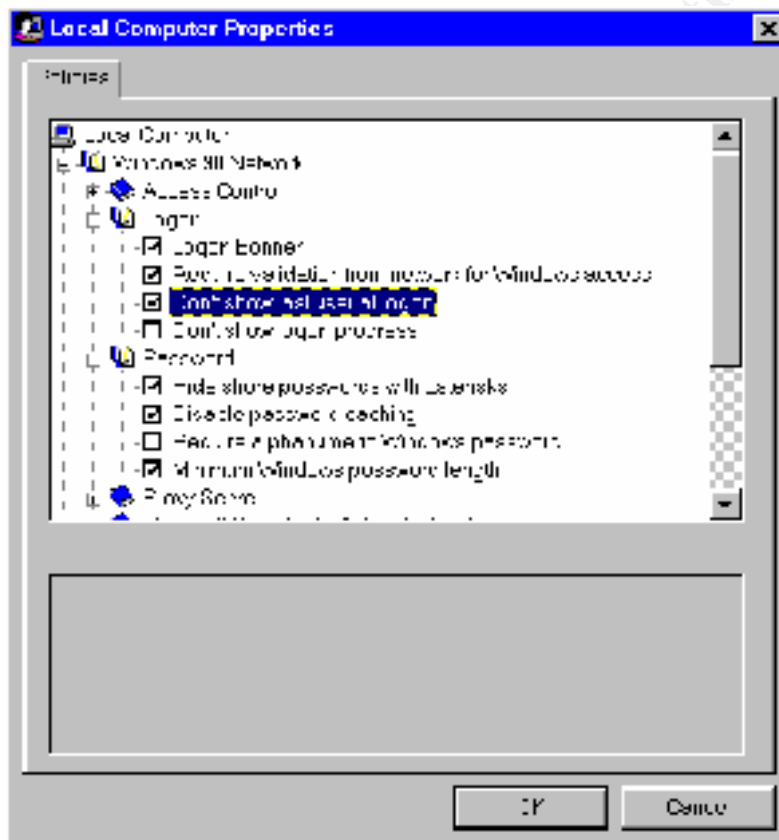
The system event logging has been broken for some time, and must be fixed somehow.

Task scheduler is only available for administrator:

Not pass: Windows 95/98 has no known way of doing this – it appears to only work for NT and Windows 2000, probably XP as well. Any user with console access can schedule any tasks, even those with administrator access.

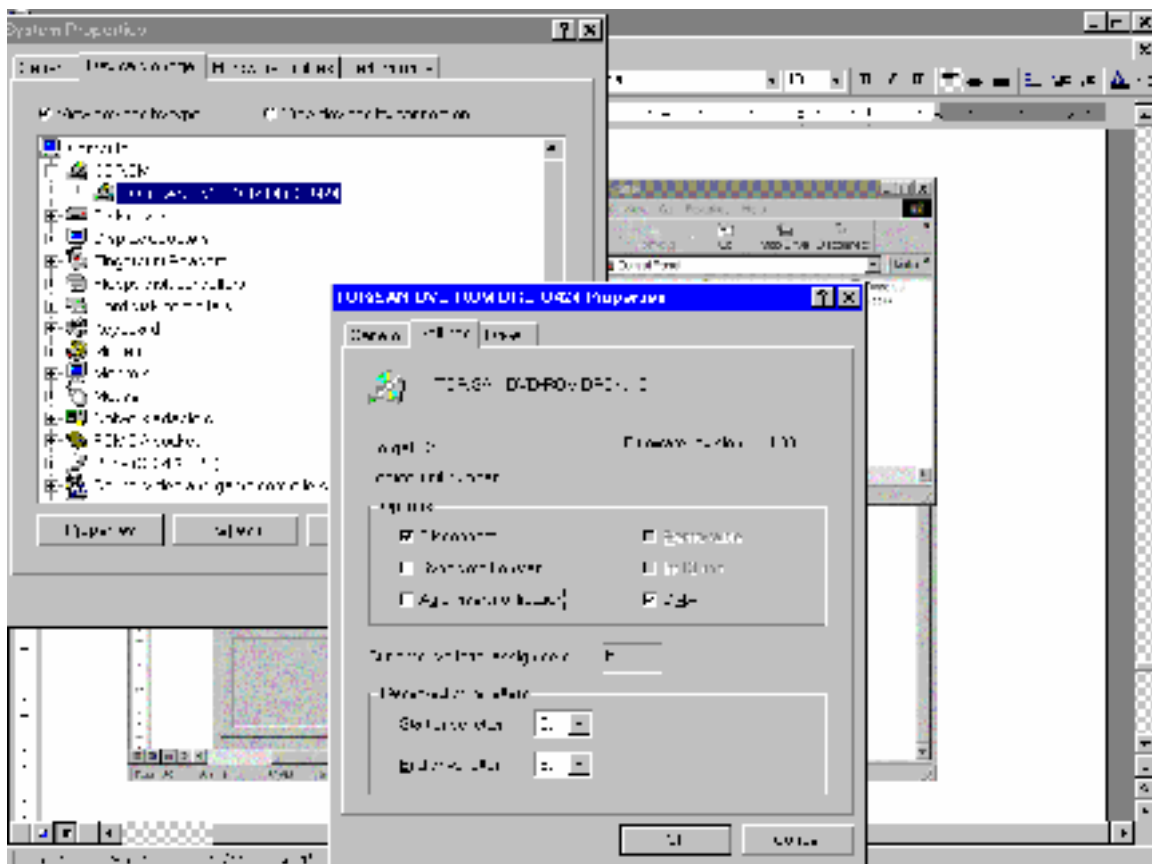
ROM-BIOS password is set: Pass, upon reboot, any attempt to change CMOS settings requires a password.

Refuse Windows access without network connection: Pass – see below.

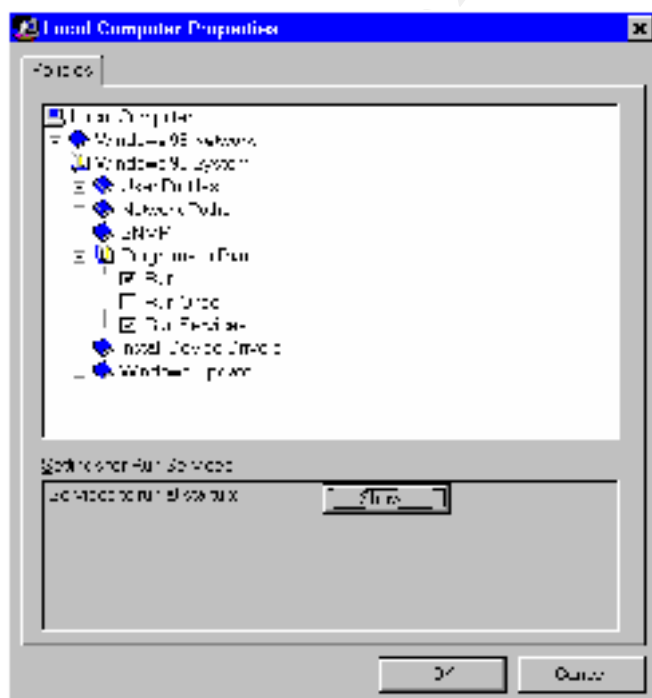


Autoren by CD player is disabled: Not pass – see below, noting that Auto-insert notification is now turned off in the Control Panel, System, Device Manager, Properties, Settings panel (There is no such setting for Floppy disks in the standard floppy controller device)





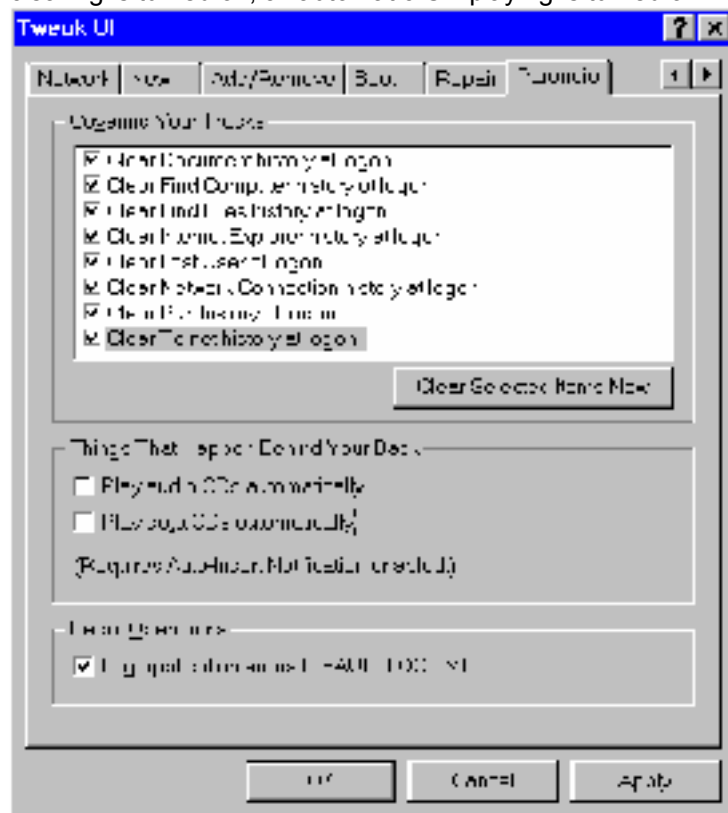
The inetd service is not enabled, and no other services or processes are run at startup which are not specifically desired, as shown below in the poedit.exe, Local Computer panel. Both Run and Run services should be examined by clicking the Show... button -- Pass



Backups and restores are not logged, same issues as with system event logging. Not pass.

Screensaver locks console after inactivity of 10 minutes. Pass.

Virtual memory pagefile is cleared on shutdown; Not pass: Unable to figure how to do this for Windows 95/98, also, this should be done on logoff, rather than shutdown. Here is the next best thing that could be implemented for Windows 98. This is the TweakUI (<http://www.annoyances.org/exec/show/tweakui>) panel of the Control Panel, the Paranoia tab. All clearing is turned on, all automatic CD playing is turned off.

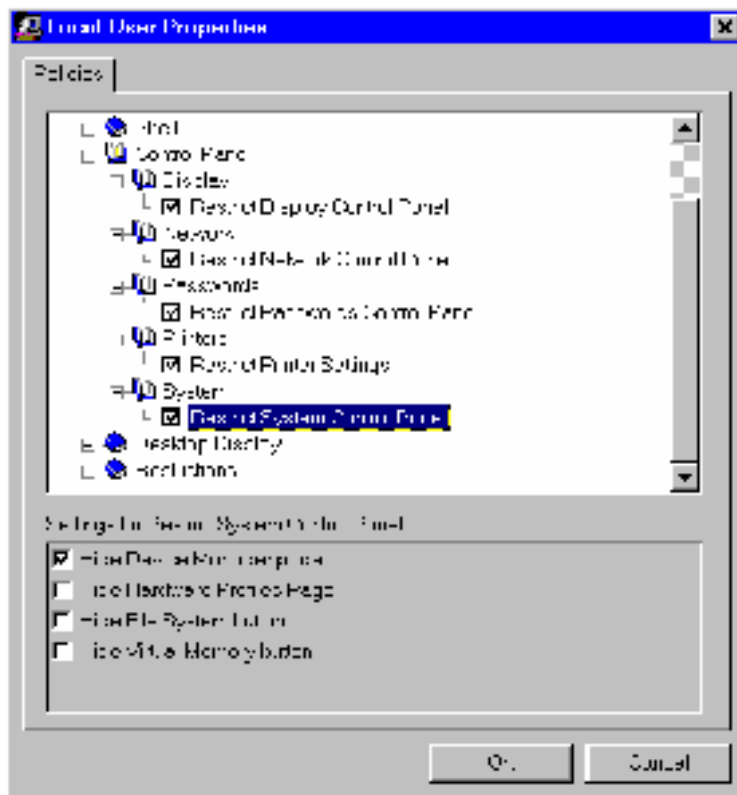


Last username is removed from the logon screen: Pass – see screenshot above (Clear Last User at logon), and three panels back poledit.exe (Don't show last user at logon).

Logon banners have legally binding warning text: Pass

Legal disclaimer and warning: Unauthorized access is prohibited. Unlawful use of any of these resources will be prosecuted to the fullest extent of California and United States law.

Driver installation is prohibited except for administrator: Not pass – No way is known for Windows 95/98 to actually restrict driver installation. It can be made more difficult by restricting the user access to the control panel items for the System Device Manager panel, Printers addition and deletion, and Network control panel items. Browser restrictions will also mitigate this risk.



Administrator account is renamed to delay compromise. Not pass: it is still “administrator”

No guest or other unrecognized accounts are allowed: Pass.

System has local firewall software installed and configured: Not pass – no such software

Biometric software declines non-matching fingerprint more than 100 times with no positives. Pass

Browser settings Refuse: all unsigned except active scripting, Prompts for signed applets/ActiveX, Allow active scripting. Pass. All zones the same, including intranet, which scope can be spoofed from compromised outside web sites. Policy is also very restrictive in terms of downloads, except for Microsoft Corporation, which is always an exception to standard security procedures, such as signature checking.

All file and print sharing is disabled by policy: Not pass – corrected, see below – in addition, registry editing should be restricted for non-privileged users (bonus)





Reputable antivirus software is installed, enabled, and up to date. Not pass – McAfee and Symantec are both more than a year out of date. Note that no email attachments are allowed unless confirmed from a reputable source, and no web server has ever been running on this machine.

Password caching is disabled: Pass – see graphic for “Refuse Windows access without network connection” checklist item.

Vulnerability assessment: Pass, but conditional even after remedial action. Now passes, but still reveals host name and domain name as well as MAC address. ICMP and SNMP are filtered from going to this machine by the DMZ host, but IP numbering leaves all connections from this machine vulnerable to spoofing and hijacking.

**Note: assume all communication from this machine can be easily sniffed.**

**Note: To disable remote logon, including administration with default passwords and null sessions, go to Control Panel, Network, Access Control, select User Level Access, and use the local domain name to obtain users and groups.**

Nessus Scan Report  
-----

#### SUMMARY

- Number of hosts which were alive during the test : 1
- Number of security holes found : 0
- Number of security warnings found : 4
- Number of security notes found : 2

#### TESTED HOSTS

192.168.1.2 (Security warnings found)

#### DETAILS

- + 192.168.1.2 :
  - . List of open ports :
    - o netbios-ssn (139/tcp)
    - o netbios-ns (137/udp) (Security warnings found)
    - o general/udp (Security notes found)
    - o general/tcp (Security warnings found)
    - o general/icmp (Security warnings found)
  - . Warning found on port netbios-ns (137/udp)
  - . The following 8 NetBIOS names have been gathered :
    - DEAVES-IN = This is the computer name registered for workstation services by a WINS client.

ISC = Workgroup / Domain name  
DEAVES-IN = Computer name that is registered for the messenger service on a computer that is a WINS client.  
DEAVES-IN  
ISC  
ISC

\_\_MSBROWSE\_\_  
DEAVES = Computer name that is registered for the messenger service on a computer that is a WINS client.

- . The remote host has the following MAC address on its adapter :  
0x00 0xe0 0x29 0x56 0x88 0xcd

If you do not want to allow everyone to find the NetBios name of your computer, you should filter incoming traffic to this port.

Risk factor :  
Medium

- . Information found on port general/udp

For your information, here is the traceroute to 192.168.1.2 :  
192.168.1.2

- . Warning found on port general/tcp

The remote host uses non-random IP IDs, that is, it is possible to predict the next value of the ip\_id field of the ip packets sent by this host.

An attacker may use this feature to determine if the remote host sent a packet in reply to another request. This may be used for portscanning and other things.

Solution : Contact your vendor for a patch  
Risk factor :  
Low

- . Information found on port general/tcp

QueSO has found out that the remote host OS is  
\* WindowsNT, Cisco 11.2(10a), HP/3000 DTC, BayStack Switch

CVE : CAN-1999-0454

- . Warning found on port general/icmp

The remote host answers to an ICMP timestamp request. This allows an attacker to know the date which is set on your machine.

This may help him to defeat all your time based authentications protocols.

Solution : filter out the icmp timestamp requests (13), and the outgoing icmp timestamp replies (14).

Risk factor : Low  
CVE : CAN-1999-0524

- . Warning found on port general/icmp

The remote host answered to an ICMP\_MASKREQ query and sent us its netmask.

An attacker can use this information to understand how your network is set up and how the routing is done. This may help him to bypass your filters.

Solution : reconfigure the remote host so that it does not answer to those requests. Set up filters that deny ICMP packets of type 17.

Risk factor : Low  
CVE : CAN-1999-0524

-----  
This file was generated by the Nessus Security Scanner

Registry write is disabled: Pass – see poledit.exe, Local User, Windows 98 System, Restrictions, Disable Registry Editing tools is checked. **Note: user can write to the registry from poledit.exe if they have the executable, and then can use regedit.exe to further edit.**

UPS on LAN and backups are done reliably: Not pass – No UPS, and no regular Windows 98 content backups, monthly manual backups only.

Summary of Remedies, in order of subjective estimate of cost/time, and triaged:  
Items corrected in the course of the audit:

- 1) Dialup disabled
- 2) File, Print sharing disabled
- 3) Registry not writeable by non-privileged users – **Note, add to checklist**
- 4) Autorun disabled for CD player
- 5) Vulnerability test item: remote administration removed from network access control.

Remedial actions to be taken:

- 6) Local firewall software licensed, installed, configured
- 7) Antivirus software licensed, installed, updated
- 8) Task Scheduler must be restricted from non-privileged users
- 9) Prohibit non-privileged user driver installation (all software?)
- 10) System auditing and event logging must be investigated and made functional.
- 11) System logging for backups and restores made functional – same as above
- 12) System pagefile cleared on logout/shutdown
- 13) Purchase UPS and set network backup policy for Windows 98

Lower priority:

- 14) Account lockouts
- 15) Administrator account should be renamed

Final Audit for System #2 was conducted December 7, 2001, and no claim is made here for the condition of this system on any date after that.

Supporting matrixes for risk mitigation analysis follow:

Failed checklist items represent risks of damage, times annual frequency/likelihood of a related exploit that could otherwise be prevented. These are subjective estimates provided by the management, whose assistance was invaluable in preparing this report.

	Local Firewall: netbios exploit	Antivirus software: new virus delivery	Task scheduler: privilege escalation	Install drivers: careless users	Auditing, logging: anything at all	Clear pagefile: Premises intrusion	UPS, net backups: power outage
System #2	0.1	0.1	0.1	0.1	1.0	0.5	0.5

Assumptions are that both firewall and antivirus software represent protection from infrequent, though severe threats, due to the minimal nature of network services offered and frequency of new system level exploits for Windows 98 that are not already addressed. Similarly for privilege escalation via the task scheduler and Trojans from drivers installed by careless users, damages are large or total, but the likelihood of exposure is low.

Threats from lack of logging or auditing of any meaningful kind are total and not in any way mitigated. No attempted surveillance or exploit can be detected, and any intrusion detection will be severely impaired in case of other damage to assets.

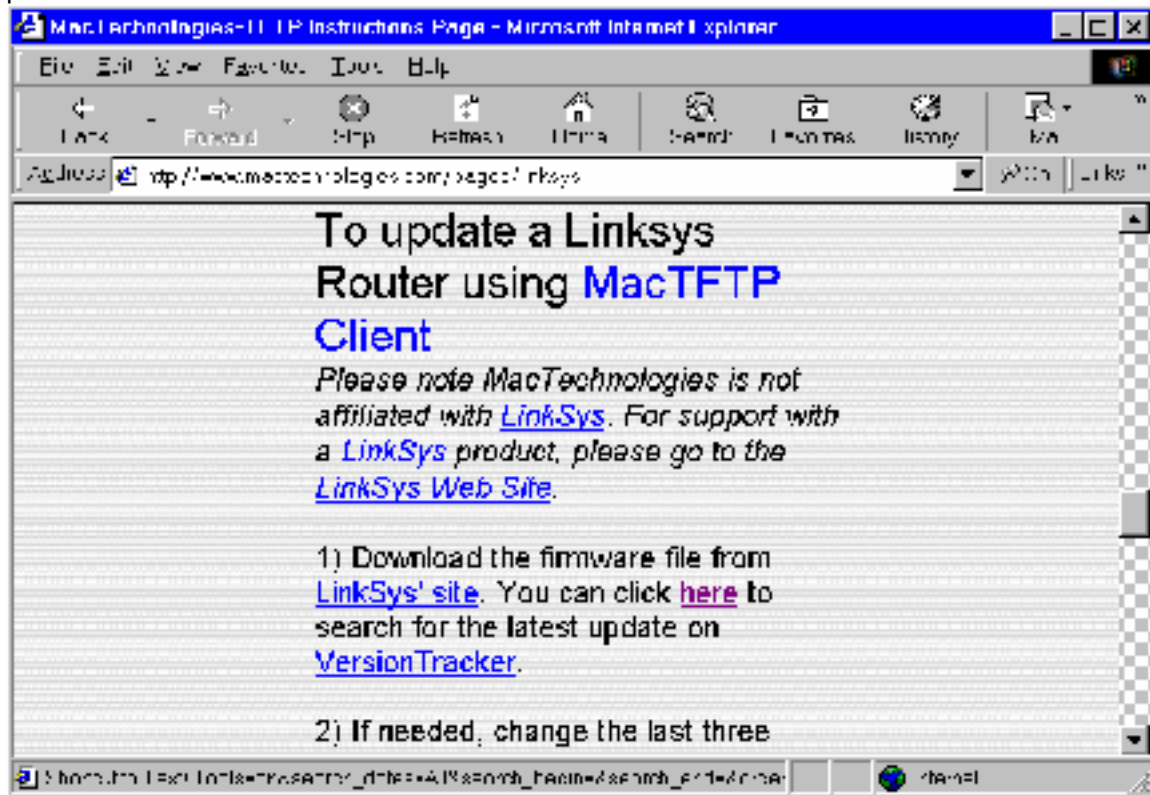
Threats from physical intrusion onto the premises, and from power failure are described at the end of the previous section, and their proportion is duplicated here.

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## Appendix C: Benchmark and Matrixes, System #3

Latest patches are installed: click here, as per reference 1 in the Linksys Router auditing procedure described in Part I.



and get the following (searching at [www.versiontracker.com](http://www.versiontracker.com) for Linksys and MacOS – see screenshots below). The version shown here indicates that the Nov 7, 2001 release is the latest version. There are extensive version notes, which indicate that the only serious changes made have been mostly in the LAN-side web interface.

This update has been installed, as is generally indicated in the subsequent screen shot by the October 23, 2001 date. Version numbers match, and, since this is subsequent to the purchase of the router, and only one firmware update has ever been installed, it can be deduced that this update is one and the same.

It should be noted that logging is deficient, as no administrative events of any kind, or access to the administrative interface are logged, apparently. The incoming and outgoing logs appear to have timestamps, and source and destination addresses and ports only, but not any indication which protocol appears in the IP header, or traffic measurement per connection.



Macintosh Software Updates - VersionTracker.com - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites Library View

Address http://www.versiontracker.com/new\_search\_words\_1\_N&mode=Advanced&product=... With Links

VersionTracker.com MacRabbit.com Marketplace Developers the techtracker network

**versiontracker.com**


famous GREEK gods...

Pre Mac OS Mac OS X Windows Palm OS Search: [ ] OS Advanced search

Download New Downloads Subscribe

Search Results: (based on 3 results in 1 sec)

Title (click name for details) Description	Version	Size	Downloads	Date
<a href="#">Linksys 1-4 port cable DSL router 1.40.2</a> - BEFSX4L & BEFSX4L Search		345K	Updats	11/11/2001
<a href="#">Linksys 1-4 port cable DSL router 1.40.2</a>				

 **Smalldog.com**

3 hours ago containing the following address...

http://192.168.1.1/index.htm - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites Library View

Address http://192.168.1.1/index.htm With Links

**LINKSYS** Setup Password Status DHCP Log Security Help Advanced

## SETUP

This screen contains all of the router's basic setup functions. Most users will be able to use the router's default settings without making any changes. If you require help during configuration, please see the user guide.

Host Name: C362401-a (required by some ISPs)

Domain Name: @HDMF (required by some ISPs)

Firmware Version: 1.40.2, Oct 23 2001

LAN IP Address: (MAC Address 00:04:5A:2A:84:E3)  
192 . 168 . 1 . 1 (Default IP Address)  
255.255.255.248 (Subnet Mask)

WAN IP Address: (MAC Address 00:13:8A:7A:04:14)  
☒ Obtain an IP Address Automatically  
☐ Specify an IP Address 0 . 0 . 0 . 0

Vulnerability assessment tool shows negative database match:  
LAN-side performed by nessus, running from 192.168.1.3, LAN, or clean side, onto 192.168.1.1

Nessus Scan Report

-----

SUMMARY

- Number of hosts which were alive during the test : 1
- Number of security holes found : 1
- Number of security warnings found : 2
- Number of security notes found : 2

TESTED HOSTS

192.168.1.1 (Security holes found)

DETAILS

+ 192.168.1.1 :

- . List of open ports :
  - o http (80/tcp) (Security hole found)
  - o general/udp (Security notes found)
  - o general/tcp (Security warnings found)
  - o domain (53/tcp) (Security warnings found)
- . Vulnerability found on port http (80/tcp) :

The remote proxy is vulnerable to format strings attacks when issued a badly formed user name.

This flaw allows an attacker to execute arbitrary code on this host.

Solution : if you are using NSM, see  
[http://www.solsoft.org/nsm/news/972559672/index\\_html](http://www.solsoft.org/nsm/news/972559672/index_html)  
or else contact your vendor for a patch

Risk factor :  
High

- . Information found on port general/udp

For your information, here is the traceroute to 192.168.1.1 :  
192.168.1.1

- . Warning found on port general/tcp

The remote host uses non-random IP IDs, that is, it is possible to predict the next value of the ip\_id field of the ip packets sent by this host.

An attacker may use this feature to determine if the remote host sent a packet in reply to another request. This may be used for portscanning and other things.

Solution : Contact your vendor for a patch  
Risk factor :

Low

. Warning found on port domain (53/tcp)

The remote name server allows recursive queries to be performed by the host running nessusd.

If this is your internal nameserver, then forget this warning.

If you are probing a remote nameserver, then it allows anyone to use it to resolve third parties names (such as www.nessus.org). This allows hackers to do cache poisoning attacks against this nameserver.

Solution : Restrict recursive queries to the hosts that should use this nameserver (such as those of the LAN connected to it). If you are using bind 8, you can do this by using the instruction 'allow-recursion' in the 'options' section of your named.conf

If you are using another name server, consult its documentation.

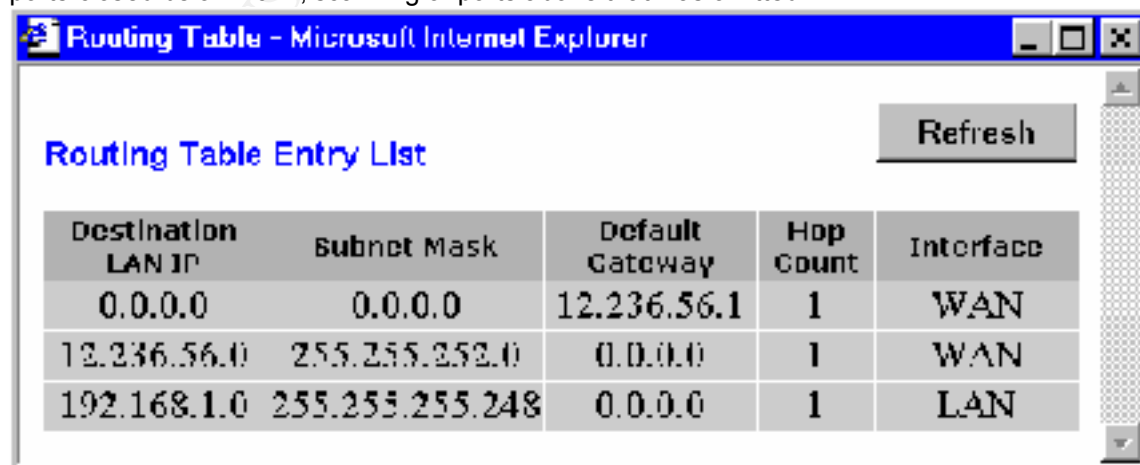
Risk factor :  
Serious

. Information found on port domain (53/tcp)

The remote bind version is :  
no

-----  
This file was generated by the Nessus Security Scanner

WAN-side, performed by nessus, making sure that the Linksys router is set temporarily to be the DMZ host, so that packets addressed to the assigned IP address are routed back to the WAN side of the Linksys router. Considering that the routing table below has no direct reference to the local IP address actually assigned by DHCP, IP packets addressed to the external ISP-assigned address 12.236.57.n must at least reference the upstream router (or at least send and receive SNMP) before returning via the WAN interface. The cable modem was observed to show activity corresponding to all requests to and responses from 12.236.57.n. Since port scanning showed all ports closed below 1024, scanning of ports above that was omitted.



Destination LAN IP	Subnet Mask	Default Gateway	Hop Count	Interface
0.0.0.0	0.0.0.0	12.236.56.1	1	WAN
12.236.56.0	255.255.252.0	0.0.0.0	1	WAN
192.168.1.0	255.255.255.248	0.0.0.0	1	LAN

SUMMARY

- Number of hosts which were alive during the test : 1
- Number of security holes found : 0
- Number of security warnings found : 0
- Number of security notes found : 1

TESTED HOSTS

12.236.57.nnn (Security notes found)

DETAILS

- + 12.236.57.nnn :
  - . List of open ports :
    - o general/udp (Security notes found)
  - . Information found on port general/udp

For your information, here is the traceroute to 12.236.57.nnn :  
?

-----  
This file was generated by the Nessus Security Scanner

Summary: Not pass – requires a patch to the web server on the LAN side administrative interface to prevent format string overflow attacks from within the network. Since this is on the LAN or clean side, rather than on the WAN or dirty side, this risk is minimal as long as physical access to the router is limited. Having investigated this, there is no such patch available. However there is no third party verification of the vulnerability, or any explanation from Nessus what the criterion was for making this determination, and the software claimed does not match the name of Mac Technologies, the third party developer for Linksys, so the actual risk is undetermined.

Router has no users other than one administrator, this has a nontrivial password:

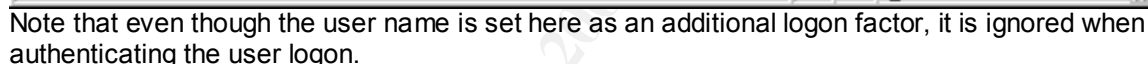
Not pass: The Linksys router appears to allow any username to log into the administrative interface. It appears to authenticate based on only password, and no other credential. The password is set and is nontrivial.

Has correct ISP-specified parameters:

As can be seen the screen shot before the previous one, DHCP is selected, and the inherited host name and domain name from prior to the Excite@home bankruptcy proceeding (which is still supported by AT&T Broadband evidently) are in force. The DNS servers are not shown, as they are temporarily set to query the remote systems (see subsequent Appendixes), and an AT&T name server. When AT&T Broadband notifies their new clients of DNS assigned servers, these will be assigned permanently. The actual IP address assigned to this private network can be seen in the Status panel (not shown here).

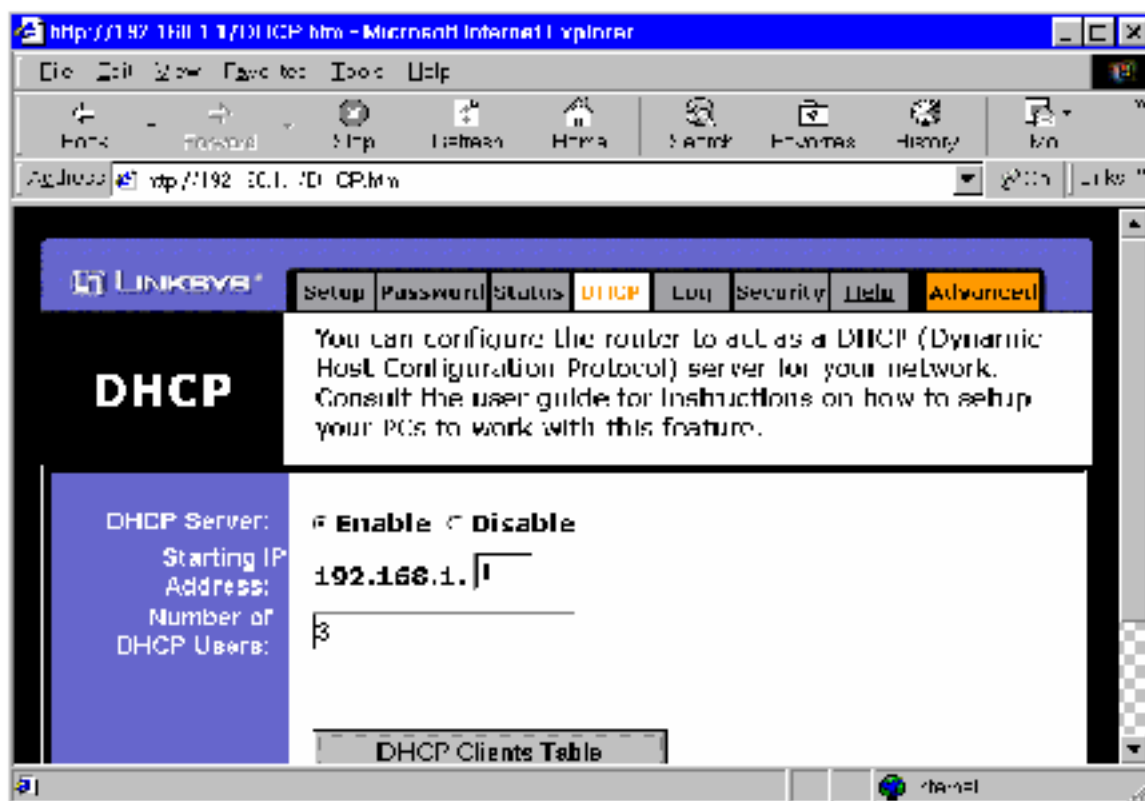
Pass.

Remote login is disabled – below (Main setup page, bottom)



Router cannot force factory configurations: 403 is returned when attempting to replay a factory settings reset HTTP request from the password panel. If the TCP session could be sniffed from inside the network, however, it could be spoofed and the basic authentication bypassed to reset the administrative password. This could be detected however, as the old password would have been lost. Pass:

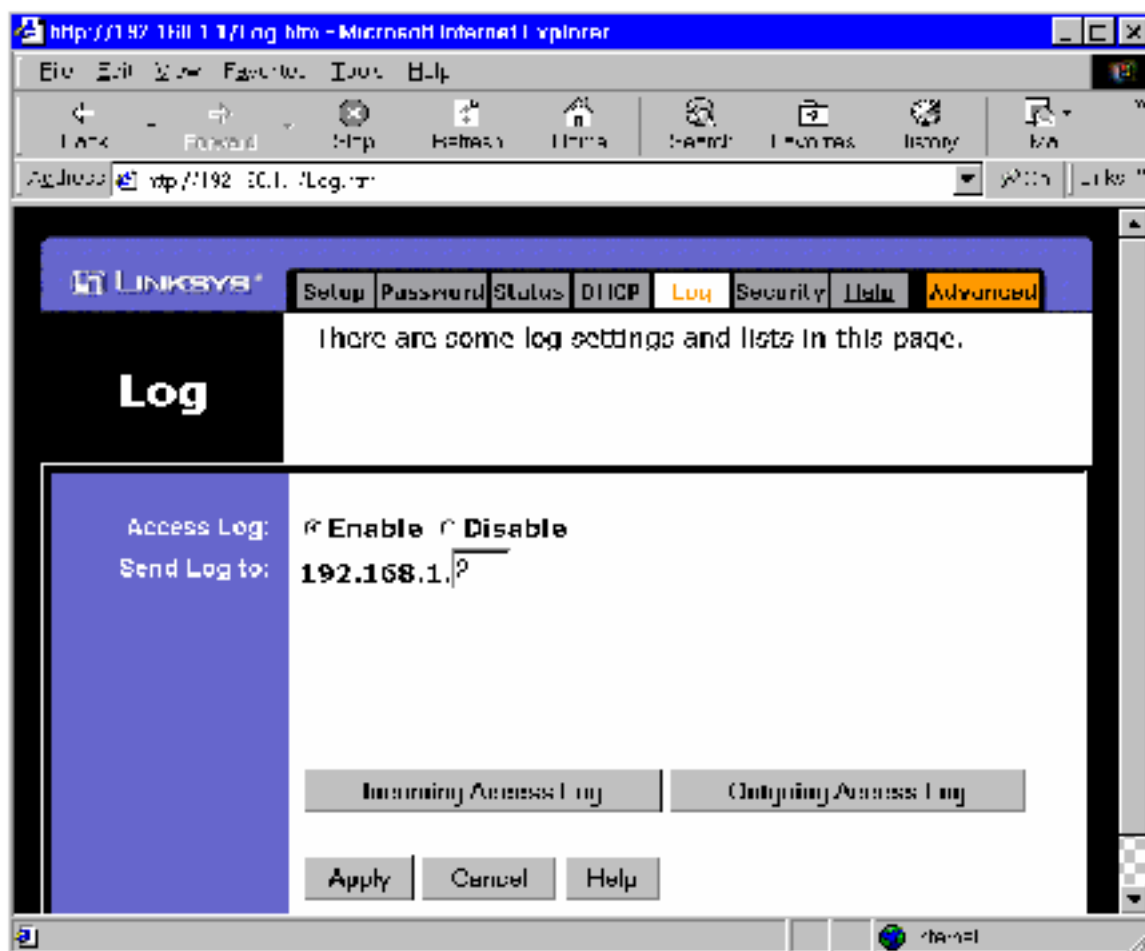
Number of DHCP users is minimal for the network (preventing some kinds of surveillance spoofing): Pass – see below



Log viewing interface views in and out access logs: Pass – note that the logs are kept on one of the network systems, not the router. For further research, where these are kept and by what process would be of interest – Find files modified more recently than the last hour has been attempted on both System #1 and System #2 with no results.

Also note that even using the LogViewer application, downloaded from the Linksys site, there is no more information logged than source and destination addresses and ports, and timestamps. This can help corroborate other, more detailed logging systems, but it is insufficient as a security device, especially considering that administrative events are not audited or logged.

There also appears to be an intermittent error having to do with logging: occasionally a malformed packet will be logged as from an unroutable address (e.g. 0.0.0.0), and whose timestamp corresponds only with one set of requests that another sniffer (ethereal) shows as having come from an address of a connection or related connection in use at the time. This could also be due to errors in the version(s) of SSH in use, or other sniffers and session-hijacking attempts in between: it only seems to occur when communicating with secure-sockets (SSL) wrapped HTTP.



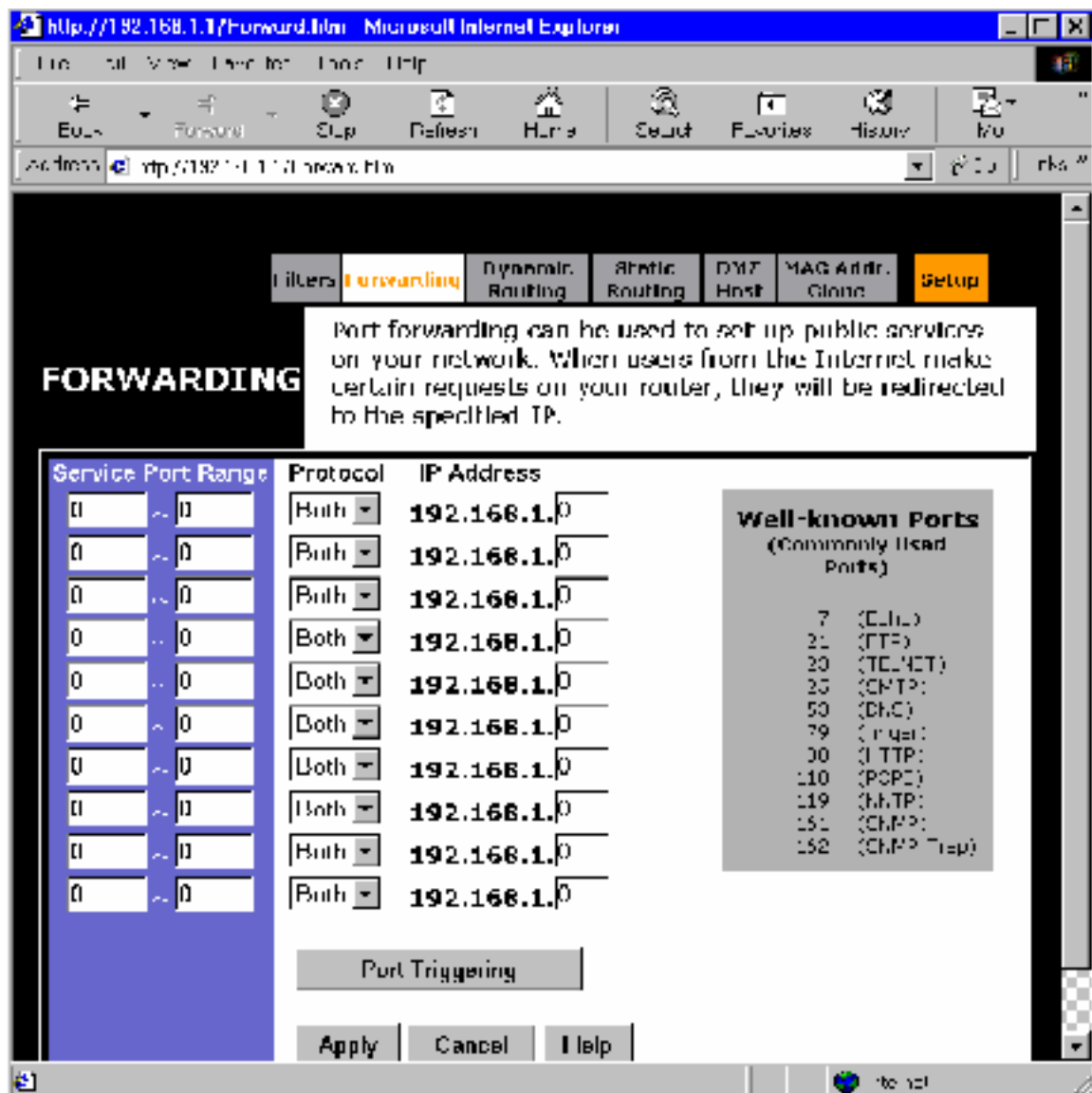
If ZoneAlarm or PC-cillin is in use from the router, then it is enforced with only the DMZ firewall exempted: Pass – not in use at this time. See firewall and antivirus failures in System #1 and System #2 audits.

Port filtering implements secure ACL's: Not pass: Not possible with this device. Access is automatic, and no other port access is filtered, except for outbound, and that is not state based, requiring that all destination port traffic be blocked. Since System #1 is used for scanning services, it must allow all ports outbound from this network.

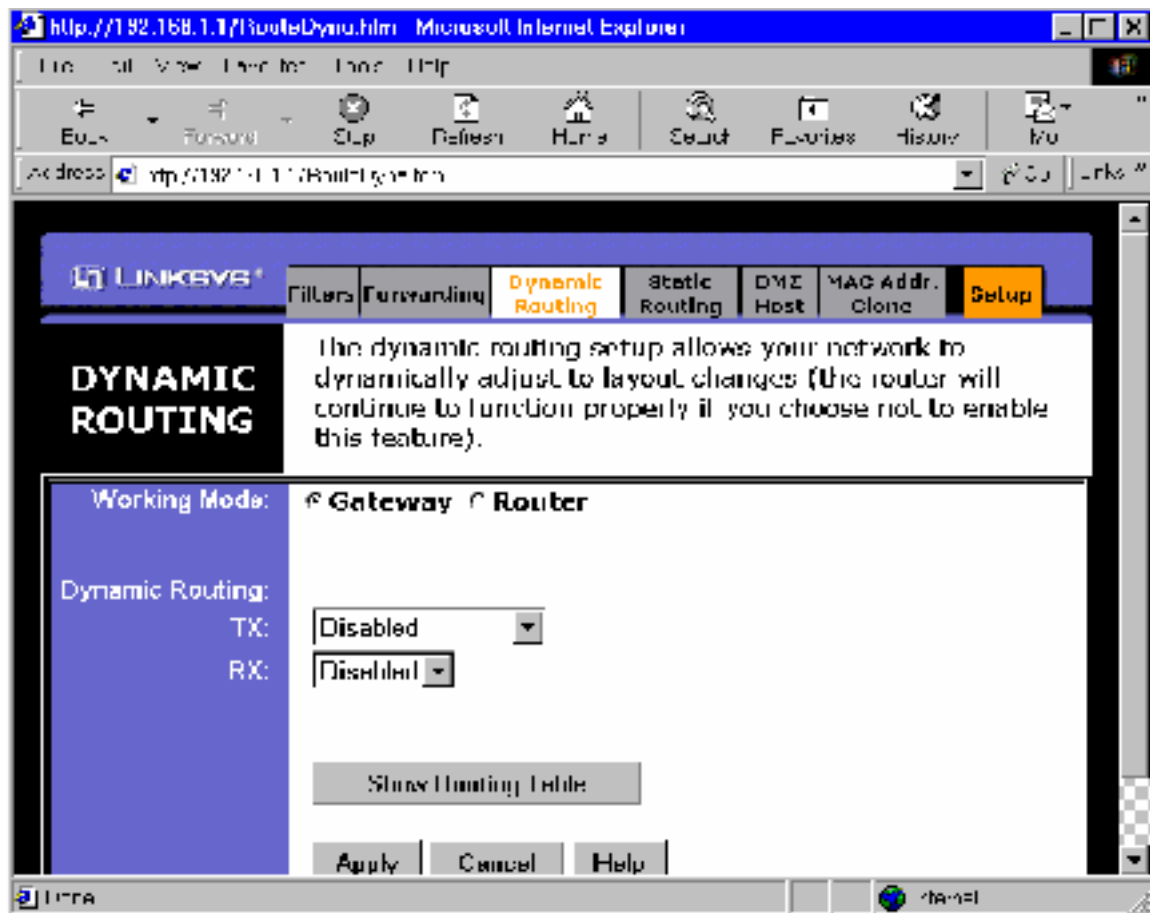
Under other circumstances the benchmark should generally restrict outbound traffic between 1025-65535, which should not impact most networks' usability, and generally prevents certain Trojans from propagating, should they gain access. Even blocking outbound 501-65535 should have little impact on most networks that don't share print servers, but below port 500 one starts to involve key exchange (IKE), HTTPS, and more commonly used network services.

There is no port forwarding in place for this router: Pass: see screen shot below





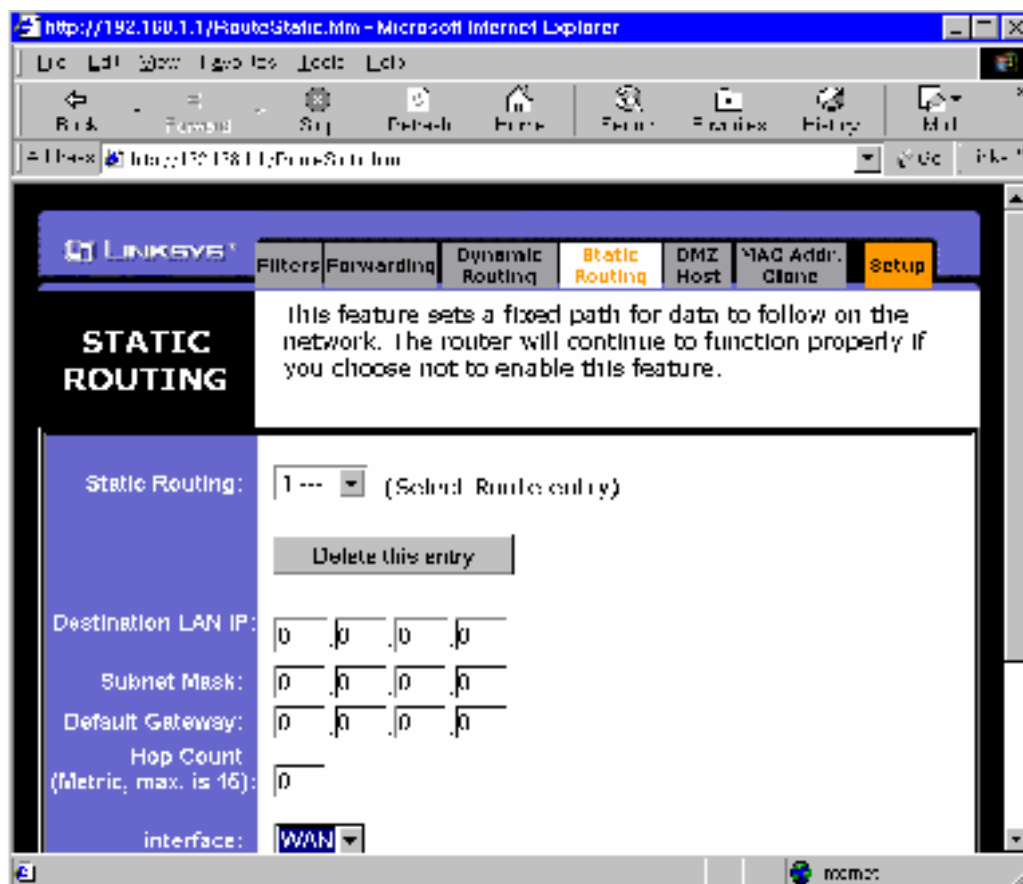
All dynamic routing is disabled, gateway mode, not router mode: Pass



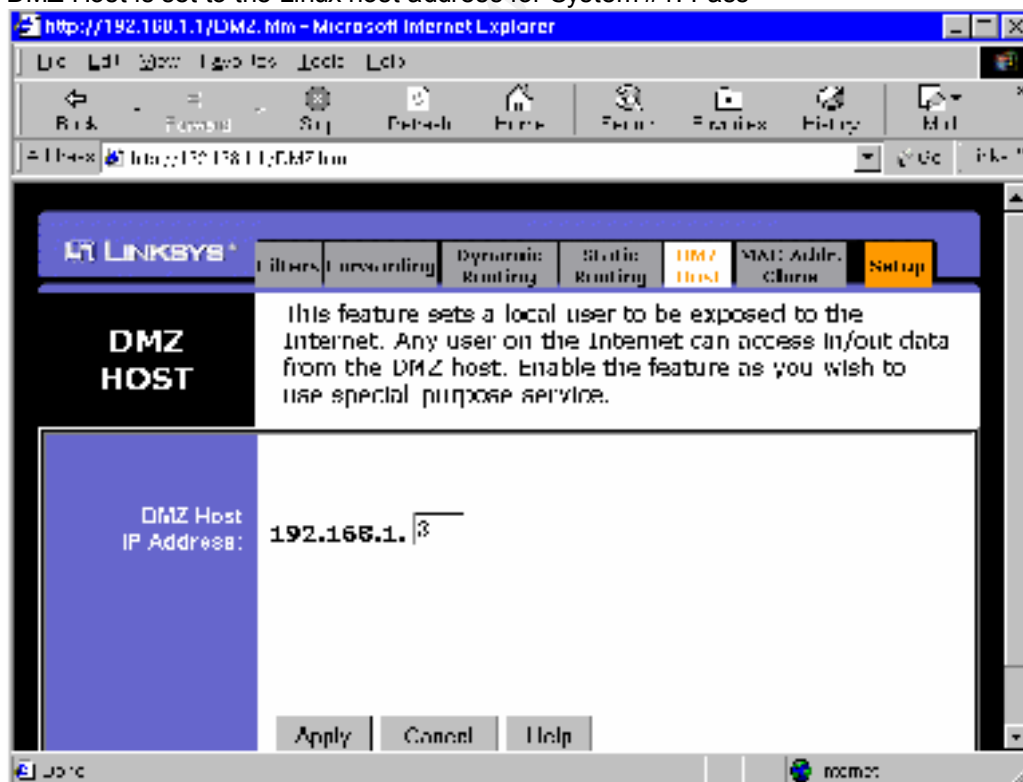
Static WAN routes exist only for ISP-designated gateways, or none if using DHCP for the WAN side: Pass – using DHCP on the WAN side.

Note in the screenshot below that the Static Routing select drop down is actively scripted. It must be tested for each static route in the list, and has been. There are no static routes defined at all. Since MAC addresses cannot be defined associated with static LAN routes in this appliance, there seems to be little security to gain from requiring only static LAN routes. Internal DHCP is therefore in use, as seen in earlier screen shots. See the routing table shown above.

Note: One can gain a marginal increase in security by using static LAN routes to set mid-range, or random internal IP addresses, away from 254 and 1, so as to frustrate some kinds of surveillance. But this would also allow other kinds of spoofing and network surveillance.



DMZ Host is set to the Linux host address for System #1: Pass



Internal LAN addresses are set away from 1 and 255, making surveillance more difficult: Not pass – using DHCP and dynamic LAN side routes.

Summary of Remedies, in order of subjective estimate of cost/time, and triaged:

Remedial actions to be taken:

- 1) Set ACL's for outbound port filtering while not in use for security scanning services
- 2) Set static LAN routes, allowing for random and mid range internal addressing to frustrate some surveillance.
- 3) Change the name servers to appropriate servers that are not vulnerable to recursion and cannot be poisoned (partial checklist fix)

Lower priority:

- 4) LAN-side web server format string overflow vulnerability requires a manufacturer patch to the web server (partial checklist fix)
- 5) Login to administrative interface requires a patch from the manufacturer to require a username match in addition to password

Final Audit for System #2 was conducted December 7, 2001, and no claim is made here for the condition of this system on any date after that.

Supporting matrixes for risk mitigation analysis follow:

Failed checklist items represent risks of damage, times annual frequency/likelihood of a related exploit that could otherwise be prevented. These are subjective estimates provided by the management, whose assistance was invaluable in preparing this report.

	Outbound ACL's while unused: some new exploits prevented	Static LAN routes: SNMP surveillance frustrated	Secure DNS sources: DNS cache poisoning prevented
System #3	0.05	0.1	0.1

Note that the only damage from poisoned DNS servers would be temporary, and the consequences would include responses to local DNS requests possibly being spoofed. No assets of the company are anticipated at risk in this case, other than time spent detecting and addressing the problem.

## Appendix D: Benchmark and Matrixes, Remote System #1

The assessment of remote system #1 includes a checklist-of-checklists for the system generally, and a supplemental web application assessment. Remote system #1 hosts ssh services, and is shared with another virtual host that runs the corporate web site, – see Part I for a description of this checklist. The network diagram for the remote network, including its unusual routing details, will be kept confidential at the request of the network owner, and because they themselves are not owned by the organization being audited, only some IT assets residing upon them.

The CIS Solaris ruler measurement (internal vulnerability report):

The network owner was reticent to allow permission for such an internal procedure to be run, considering that it requires root access to be made and executed. Not pass.

The external vulnerability reports – both virtual hosts, ssh host and web host: we use insider knowledge here, that both IP addresses are served by the same actual host, and threats to the one are the same as threats to the other.

SSH/SMTP host (IP ending octets edited out):

Nessus Scan Report  
-----

### SUMMARY

- Number of hosts which were alive during the test : 1
- Number of security holes found : 0
- Number of security warnings found : 2
- Number of security notes found : 4

### TESTED HOSTS

192.86.83.nnn (Security warnings found)

### DETAILS

- + 192.86.83.nnn :
  - . List of open ports :
    - o general/udp (Security notes found)
    - o ssh (22/tcp) (Security warnings found)
    - o smtp (25/tcp) (Security warnings found)
    - o telnet (23/tcp) (Security notes found)
  - . Information found on port general/udp
- For your information, here is the traceroute to 192.86.83.nnn :
  - ?
- . Warning found on port ssh (22/tcp)

You are running a version of SSH which is older than (or as old as) version 1.2.27.

If you compiled ssh with kerberos support, then an attacker may eavesdrop your users kerberos tickets, as sshd will set the environment variable KRB5CCNAME to 'none', so kerberos tickets will be stored in the current working directory of the user, as 'none'.

If you have nfs/smb shared disks, then an attacker may eavesdrop the kerberos tickets of your users using this flaw.

\*\* If you are not using kerberos, then ignore this warning.

Risk factor : Serious  
Solution : use ssh 1.2.28 or newer  
CVE : CAN-2000-0575

. Information found on port ssh (22/tcp)

Remote SSH version : SSH-1.5-1.2.26

. Warning found on port smtp (25/tcp)

The remote SMTP server answers to the EXPN and/or VRFY commands.

The EXPN command can be used to find the delivery address of mail aliases, or even the full name of the recipients, and the VRFY command may be used to check the validity of an account.

Your mailer should not allow remote users to use any of these commands, because it gives them too much informations.

Solution : if you are using sendmail, add the option  
O PrivacyOptions=goaway  
in /etc/sendmail.cf.

Risk factor : Low  
CVE : CAN-1999-0531

. Information found on port smtp (25/tcp)

Remote SMTP server banner :  
220-system1.WLK.Com[192.157.31.zzz] SMTP listener readyESMTP spoken here.  
214-Commands

214-HELO EHLO MAIL RCPT RSET ONEX

214 VERB DATA NOOP QUIT HELP VERB

. Information found on port telnet (23/tcp)

Remote telnet banner :  
ÿ-\$

-----  
This file was generated by the Nessus Security Scanner

## SSH/HTTP host:

The scan for the virtual host assigned to manage the web site follows:

### Nessus Scan Report

-----

#### SUMMARY

- Number of hosts which were alive during the test : 1
- Number of security holes found : 1
- Number of security warnings found : 2
- Number of security notes found : 3

#### TESTED HOSTS

www.<web\_site\_name>.com (Security holes found)

#### DETAILS

- + www.<web\_site\_name>.com :
  - . List of open ports :
    - o general/udp (Security notes found)
    - o ssh (22/tcp) (Security hole found)
    - o http (80/tcp) (Security notes found)
    - o general/tcp (Security warnings found)
  - . Information found on port general/udp

For your information, here is the traceroute to 192.86.83.nnn :

10.109.246.1  
12.244.98.129  
12.244.67.26  
12.244.72.194  
12.123.13.162  
12.122.11.89  
12.122.11.230  
192.205.32.126  
152.63.52.226  
152.63.53.250  
152.63.10.85  
152.63.101.154  
152.63.102.22  
152.63.103.145  
152.63.100.5  
204.177.254.203  
192.86.83.qqq  
?

- . Vulnerability found on port ssh (22/tcp) :

You are running a version of SSH which is  
older than version 1.2.32,  
or a version of OpenSSH which is older than

2.3.0.

This version is vulnerable to a flaw which allows an attacker to insert arbitrary commands in a ssh stream.

Solution :

Upgrade to version 1.2.32 of SSH which solves this problem, or to version 2.3.0 of OpenSSH

More information:

<http://www.core-sdi.com/english/ssh/>

Risk factor : High

CVE : CAN-2001-0144

. Warning found on port ssh (22/tcp)

You are running a version of SSH which is older than (or as old as) version 1.2.27.

If you compiled ssh with kerberos support, then an attacker may eavesdrop your users kerberos tickets, as sshd will set the environment variable KRB5CCNAME to 'none', so kerberos tickets will be stored in the current working directory of the user, as 'none'.

If you have nfs/smb shared disks, then an attacker may eavesdrop the kerberos tickets of your users using this flaw.

\*\* If you are not using kerberos, then ignore this warning.

Risk factor : Serious

Solution : use ssh 1.2.28 or newer

CVE : CAN-2000-0575

. Information found on port ssh (22/tcp)

Remote SSH version : SSH-1.5-1.2.26

. Information found on port http (80/tcp)

The remote web server type is :  
Apache/1.2.6

We recommend that you configure your web server to return bogus versions, so that it makes the cracker job more difficult

. Warning found on port general/tcp

The remote host uses non-random IP IDs, that is, it is possible to predict the next value of the ip\_id field of the ip packets sent by this host.

An attacker may use this feature to determine if the remote host sent a packet in reply to another request. This may be used for portscanning and other things.

Solution : Contact your vendor for a patch

Risk factor : Low



-----  
This file was generated by the Nessus Security Scanner

Pass: SSH is relatively safe, since no nfs/smb, or kerberos is in use, while the SMTP information giveaway is according to that system's policy.

The web server (HTTP port) is subject to the web application checklist, following:

Web server product cannot be easily identified – Not pass: Apache/1.2.6. There is no good reason to run such an old version of a free product. Replacement cost about two days out of production and employee time. Possible risks to custom CGI in other virtual hosts run by the same server. Assuming backward compatibility with the Apache C API this should require a simple rebuild of the custom modules with the new Apache header files.

No default install materials available: for address=[http://<web\\_site\\_name>.com](http://<web_site_name>.com), try address/default.html, address/index.html, address/., address/./, address/./.. All show Not found or main page except “..”, which shows parent directory. Pass – no default materials.

Available web map is correct. No web map, simple design – pass.

No well-known executables are installed in or linked to document root: examination shows only non-executable html files and one directory, for graphic content, which contains only non-executable gif files. Only directories and vi-content are executable. Latter has only commands to vi all html files. Pass – see internal listing, below

```
> ls -al
total 360
drwxr-xr-x  3 deaves  www      1536 Oct 15 17:18 .
drwxr-xr-x 12 deaves  root      512 Dec 11 13:46 ..
-rw-r--r--  1 deaves  www      4368 Jul 25 18:08 NonDisC.txt
-rw-r--r--  1 deaves  www      5822 Oct 15 21:39 about-iscorp.html
-rw-r--r--  1 deaves  www      4658 Oct 15 19:15 auth.html
-rw-r--r--  1 deaves  www      1721 Jul  2 16:54 bill_bio.html
-rw-r--r--  1 deaves  www       433 Jul  2 17:03 bob_bio.html
-rw-r--r--  1 deaves  www       538 Jul  2 10:25 ccard.html
-rw-r--r--  1 deaves  www     10596 Oct 15 17:27 cert-work.html
-rw-rw-rw-  1 deaves  www      7605 Oct 15 18:42 certification.html
-rw-rw-rw-  1 deaves  www       415 Oct 15 14:57 content-list
-rw-rw-rw-  1 deaves  www      4753 Oct 15 19:13 custom-soft.html
-rw-rw-rw-  1 deaves  www      6583 Oct 15 19:19 custom-vpns.html
-rw-r--r--  1 deaves  www      1620 Aug 27 17:53 dave_bio.html
-rw-r--r--  1 deaves  www      1412 Jul  2 16:34 earl_bio.html
-rw-r--r--  1 deaves  www      5689 Oct 15 17:27 firewall-how-to.html
-rw-rw-rw-  1 deaves  www       186 Jul 23 20:04 footer.html
-rw-r--r--  1 deaves  www     3208 Oct 15 19:11 frus-answer.html
lrwxrwxrwx  1 deaves  www         7 Oct 15 17:18 gifs -> ../gifs
-rw-rw-rw-  1 deaves  www       775 Aug 27 18:42 header.html
-rw-r--r--  1 deaves  www     4254 Oct 15 17:27 index.html
-rw-rw-rw-  1 deaves  www      5903 Oct 15 16:39 intrusion-detect.html
-rw-rw-rw-  1 deaves  www      5507 Oct 15 16:42 ironhand.html
-rw-rw-rw-  1 deaves  www       253 Jul 23 19:07 isc-style.css
-rw-rw-rw-  1 deaves  www      1128 Aug 23 15:13 left-navbar.html
-rw-r--r--  1 deaves  www      5640 Oct 15 16:49 library.html
-rw-r--r--  1 deaves  www      1297 Jul  2 10:25 mark_bio.html
-rw-r--r--  1 deaves  www      8360 Aug 27 18:42 nondisclosure.html
-rw-rw-rw-  1 deaves  www      3630 Oct 15 18:58 partners.html
-rw-r--r--  1 deaves  www      3774 Aug 27 18:43 quick-response.html
-rw-r--r--  1 deaves  www      3718 Aug 27 17:56 reach-us.html
-rw-rw-rw-  1 deaves  www         97 Jul 23 19:10 sample-table.html
-rw-rw-rw-  1 deaves  www     6519 Oct 15 16:59 sec-policy.html
```

```

-rw-r--r-- 1 deaves www 5632 Oct 15 19:00 server.html
-rw-r--r-- 1 deaves www 5872 Oct 15 17:10 service-offerings.html
-rw-rw-rw- 1 deaves www 2859 Aug 27 18:43 surround.html
-rw-rw-rw- 1 deaves www 5182 Aug 27 18:43 systems-int.html
-rw-r--r-- 1 deaves www 480 Jul 26 19:05 teacher.html
-rw-rw-rw- 1 deaves www 2859 Aug 27 18:44 template.html
-rw-r--r-- 1 deaves www 4203 Aug 27 18:44 tokens.html
-rw-rw-rw- 1 deaves www 4113 Oct 15 19:36 toolkit.html
drwxr-xr-x 2 deaves www 512 Aug 23 15:48 unused
-rwxrwxrwx 1 deaves www 418 Oct 15 14:59 vi-content
-rw-r--r-- 1 deaves www 7474 Aug 27 18:44 waiver.html
-rw-r--r-- 1 deaves www 5683 Aug 27 18:44 why-router-bastion.html

```

```
> ls -al ../gifs
```

```

total 488
drwxr-xr-x 2 deaves www 1536 Jul 23 17:01 .
drwxr-xr-x 12 deaves root 512 Dec 11 13:46 ..
-rw-rw-r-- 1 deaves www 1876 Sep 4 1997 announce.gif
-rw-rw-r-- 1 deaves www 2229 Sep 3 1997 baghead.gif
-rw-r--r-- 1 deaves www 3018 Sep 3 1997 baghead.jpg
-rw-rw-r-- 1 deaves www 2880 Sep 4 1997 books.gif
-rw-rw-r-- 1 deaves www 50 Sep 2 1997 bullet1.gif
-rw-rw-r-- 1 deaves www 8794 Sep 2 1997 button-cauce.gif
-rw-rw-r-- 1 deaves www 92 Sep 3 1997 comp_doc.gif
-rw-r--r-- 1 deaves www 771 Apr 14 1998 compaq.gif
-rw-r--r-- 1 deaves www 3811 Jan 29 1997 congrats.gif
-rw-r--r-- 1 deaves www 3634 Jan 25 2000 construction.gif
-rw-rw-r-- 1 deaves www 2011 Sep 9 1997 curbstone.gif
-rw-rw-r-- 1 deaves www 3013 Sep 3 1997 detective.gif
-rw-rw-r-- 1 deaves www 43 Sep 4 1997 dot_clear.gif
-rw-rw-r-- 1 deaves www 3506 Aug 12 1998 email6.gif
-rw-rw-r-- 1 deaves www 2221 Sep 9 1997 evalic.gif
-rw-rw-r-- 1 deaves www 102 Sep 3 1997 file_cab.gif
-rw-r--r-- 1 deaves www 341 Jan 8 1996 frus_logo.gif
-rw-r--r-- 1 deaves www 117 Jan 8 1996 frus_logo_sml.gif
-rw-rw-r-- 1 deaves www 96 Sep 3 1997 ftp.gif
-rw-rw-r-- 1 deaves www 1048 Sep 4 1997 handout.gif
-rw-rw-rw- 1 deaves www 19338 Jul 23 12:51 hex-services.GIF
-rw-rw-r-- 1 deaves www 85 Sep 3 1997 home.gif
-rw-rw-rw- 1 deaves www 3676 Jul 23 12:51 isc-name-blue.GIF
-rw-rw-rw- 1 deaves www 1091 Jul 23 12:51 keyhole-logo4-sml.gif
-rw-rw-r-- 1 deaves www 1391 Sep 8 1997 keylock.gif
-rw-rw-r-- 1 deaves www 1938 Sep 5 1997 launcher.gif
-rw-rw-r-- 1 deaves www 1483 Sep 4 1997 license.gif
-rw-r--r-- 1 deaves www 232 Jan 9 1996 line.eyes.gif
-rw-r--r-- 1 deaves www 2334 Jan 8 1996 line.sun.gif
-rw-rw-r-- 1 deaves www 680 Sep 4 1997 log.gif
-rw-rw-r-- 1 deaves www 3354 Sep 3 1997 maduser.gif
-rw-r--r-- 1 deaves www 5383 Sep 3 1997 maduser.jpg
-rw-rw-r-- 1 deaves www 82 Sep 3 1997 mail.gif
-rw-rw-r-- 1 deaves www 95 Sep 3 1997 mail_in.gif
-rw-rw-r-- 1 deaves www 96 Sep 3 1997 mail_out.gif
-rw-rw-r-- 1 deaves www 2318 Sep 3 1997 mailbag.gif
-rw-r--r-- 1 deaves www 3156 Sep 3 1997 mailbag.jpg
-rw-r--r-- 1 deaves www 2065 Jul 19 1998 mailbox.jpg
-rw-rw-r-- 1 deaves www 1947 Sep 3 1997 masked.gif
-rw-rw-r-- 1 deaves www 1042 Sep 4 1997 mbox.gif
-rw-rw-r-- 1 deaves www 1661 Sep 4 1997 microscope.gif
-rw-r--r-- 1 deaves www 5259 Jan 29 1997 noenter.gif
-rw-rw-r-- 1 deaves www 2642 Sep 4 1997 nursemed.gif
-rw-rw-r-- 1 deaves www 1537 Sep 4 1997 passport.gif
-rw-r--r-- 1 deaves www 3275 Jul 19 1998 passport.jpg
-rw-rw-r-- 1 deaves www 2522 Sep 4 1997 pinchdollar.gif
-rw-rw-r-- 1 deaves www 1558 Sep 3 1997 police.gif
-rw-rw-r-- 1 deaves www 105 Sep 3 1997 postscrp.gif
-rw-rw-r-- 1 deaves www 766 Sep 4 1997 potofgold.gif
-rw-rw-r-- 1 deaves www 2166 Sep 3 1997 prisoner.gif
-rw-rw-r-- 1 deaves www 1854 Sep 3 1997 redlight.gif
-rw-rw-rw- 1 deaves www 1929 Jul 23 17:01 rib_bar_eeeeee4.gif
-rw-rw-r-- 1 deaves www 193 Sep 2 1997 rule01.gif
-rw-rw-r-- 1 deaves www 1407 Sep 9 1997 srclic.gif

```

```

-rw-rw-r-- 1 deaves www 1705 Sep 2 1997 stamp-out-spam.gif
-rw-rw-r-- 1 deaves www 661 Sep 4 1997 suggest.gif
-rw-rw-r-- 1 deaves www 661 Sep 4 1997 suggestbox.gif
-rw-r--r-- 1 deaves www 1164 Sep 3 1997 surrender.gif
-rw-r--r-- 1 deaves www 5053 Sep 3 1997 surrender.jpg

> ls -al unused
total 594
drwxr-xr-x 2 deaves www 512 Aug 23 15:48 .
drwxr-xr-x 3 deaves www 1536 Oct 15 17:18 ..
-rw-r--r-- 1 deaves www 6110 Jul 2 10:25 activ.jpg
-rw-r--r-- 1 deaves www 9627 Jul 2 10:25 ak2.jpg
-rw-r--r-- 1 deaves www 3180 Jul 2 10:25 bastion-product.html
-rw-r--r-- 1 deaves www 4392 Jul 2 11:42 cert-inner.html
-rw-r--r-- 1 deaves www 48897 Jul 2 10:25 cert-work.ps
-rw-r--r-- 1 deaves www 937 Jul 2 10:25 frus_ad.html
-rw-r--r-- 1 deaves www 5468 Jul 2 10:25 nondisc.asc
-rw-r--r-- 1 deaves www 30498 Jul 2 10:25 nondisc.pcl
-rw-r--r-- 1 deaves www 32342 Jul 2 10:25 nondisc.ps
-rw-r--r-- 1 deaves www 10895 Jul 2 10:25 nondisc.wpd
-rw-r--r-- 1 deaves www 86462 Jul 2 10:25 policy.ps
-rw-r--r-- 1 deaves www 3649 Jul 2 10:25 product-sheet.html
-rw-r--r-- 1 deaves www 3279 Jul 2 10:25 rbl.gif
-rw-r--r-- 1 deaves www 6841 Jul 2 10:25 scat-t.jpg
-rw-r--r-- 1 deaves www 3649 Jul 2 10:25 secure-router-product.html
-rw-r--r-- 1 deaves www 32736 Jul 2 10:25 waiver.ps
-rw-r--r-- 1 deaves www 4003 Jul 2 10:25 waiver.txt
-rw-r--r-- 1 deaves www 543 Jul 2 10:25 weather.txt

```

Site server is set to resist mirroring applications: Pass – While conducting the audit, a traffic based DoS application cut off responses several times. The three sites were successfully mirrored with fewer threads, and therefore lower request frequency.

Robots.txt is set properly in each document root. Not pass – no robots.txt file is set

HTML contains no unintended name tags or comments: Not pass – minor problem in that all pages contain commented out left navigation bar item for quick-response-form.html, which submits to a URL for frus-answer.html. This latter returns a 405, resource not allowed. Other than that, and some obsolete and unused content, the revealed information looks clean.

HTML and Javascript are obfuscated or compressed: Not pass – not compressed, actually quite clearly written and easy to read.

If HTTPS, 128 encryption or better: Not applicable, no authentication for [www.<web\\_site\\_name>.com](http://www.<web_site_name>.com)

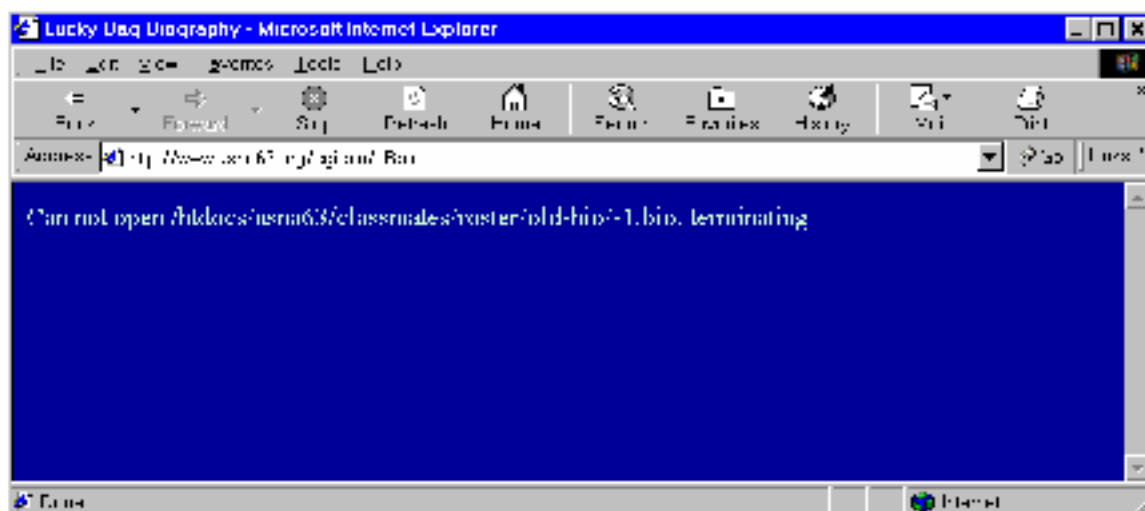
Application testing results:

[www.<web\\_site\\_name>.com](http://www.<web_site_name>.com) -- Pass, a simple site with only information and not even any forms logic, only links and static HTML. There is one form, quick-response.html that returns a 405, and has no links to it: this should be removed, and comments referring to it as well.

[www.<private1>.com](http://www.<private1>.com) -- Pass, a simple site with only information, no forms, only links and static HTML, except for links to the site below, and one link to a CGI page that displays local weather readings.

[www.<private2>.org](http://www.<private2>.org) -- Pass – See below

Forms have variables “Cur”, “Page”, “fini”, contact information such as addresses, data for HTTP MIME responses such as Have-sound and Have-RA. Cur and Page appear to be master identity indices, possibly used for session tracking (Cur), and user record indexing (Page). Responses to some boundary values indicate a mid-range database driven web application, but otherwise disclose little or no information. This database could probably be reverse engineered by examining a USNA Annapolis 1963 yearbook.



The variable Cur denotes the .bio file name used. The HTML from a yearbook bio was edited as text, and the value of Cur replaced with 0, -1, a 5000+ character string, and 999999999. One may be able to cause a stack overflow if the value can be spoofed with a large number of characters: attempting this shows that this input is truncated at 8 characters. Similar attempts with numbers and other variables show that good programming practices generally prevail within this site. No attempt at full path coverage was attempted since this site is not the property of Generic Services Corporation, and only represents a possible security exposure to the firm's own web site. Administrative functions have their own interface, which allows HTML editing, feedback approval, and email disposition. This uses basic authentication, and appears to be subject to brute force attack, but the system where these are hosted is at a separate virtual address, and appears to be firewalled off from all but a number of allowed addresses.

Browser cache does not cache private information: Pass. The related sites, [www.<private1>.com](http://www.<private1>.com) and [www.<prive2>.org](http://www.<prive2>.org) do show biographic and similar private information, intentionally, but do not compromise any known client or customer information associated with [www.<web site name>.com](http://www.<web site name>.com).

Certification Authority agency is trustworthy, only one session concurrently allowed: Not applicable, no authentication for [www.<web site name>.com](http://www.<web site name>.com).

Method of certificate authentication is itself secure: Not applicable, no authentication for [www.<web site name>.com](http://www.<web site name>.com).

If form based authentication, this submission is secure: Not applicable, no authentication for [www.<web site name>.com](http://www.<web site name>.com).

If form based and secure, additional factor is used: Not applicable, no authentication for [www.<web site name>.com](http://www.<web site name>.com).

If HTTP Basic authentication, then initially HTTPS: Not applicable, no authentication for [www.<web site name>.com](http://www.<web site name>.com).

No mixed-scope authentication schemes: Not applicable, no authentication for [www.<web site name>.com](http://www.<web site name>.com).

No concurrent authentication from different sources: Not applicable, no authentication for [www.<web site name>.com](http://www.<web site name>.com).

Authentication error message does not allow for brute force attacks: Not applicable, no authentication for [www.<web\\_site\\_name>.com](http://www.<web_site_name>.com).

Lockout of users upon too many failed authentication attempts: Not applicable, no authentication for [www.<web\\_site\\_name>.com](http://www.<web_site_name>.com).

For heavy traffic sites, load balancing, sign-on timeouts work properly: Pass, prepared well for mid range traffic, even though low traffic currently – see below

Used webstripper to download 14.5 megs of data in about 25 minutes, with only two threads in use. Four or more threads caused a DoS lockout from the web server after more than about five minutes.

If auth used, then sign off does actually sign the user off. Not applicable, no authentication for [www.<web\\_site\\_name>.com](http://www.<web_site_name>.com).

Application variables are encrypted or obfuscated: Not pass – any location or other tags are visible in the HTML, for the other two shared sites as well. Session tracking only exists for [www.<private2>.org](http://www.<private2>.org).

Any cookies with sensitive information are encrypted: Not applicable, no cookies used by [www.<web\\_site\\_name>.com](http://www.<web_site_name>.com).

If there is authentication, and if session tracking can be predicted, different IP concurrency is not allowed: Pass, administrative interface on shared web application filters IP sources.

Session inactivity timeouts are short: Not applicable, no session authentication for [www.<web\\_site\\_name>.com](http://www.<web_site_name>.com).

Form submissions are POST, not GET: Pass, no forms on [www.<web\\_site\\_name>.com](http://www.<web_site_name>.com), but all shared web application forms are POST.

Web site allowing user input filters for harmful or malicious HTML: Pass – no user material is posted at [www.<web\\_site\\_name>.com](http://www.<web_site_name>.com), but it is at [www.<private2>.org](http://www.<private2>.org), and an operator filters this for appropriate content.

Product specific vulnerabilities are specifically scanned for: Not pass: These would be buffer overflows in the Apache C API CGI modules, or Apache 1.2.6 vulnerabilities. We await a specialty checklist for that old a product, a server update, or a general CIS ruler for Apache.

Sniffing the SSH connection reveals no inappropriate information (in the case of ssh, that should be no information at all) is revealed in plaintext. Pass – see below

How to use hunt (<http://lin.fsid.cvut.cz/~kra/>) from command-line:

```
> ./hunt eth0
/*
 *      hunt 1.5
 *      multipurpose connection intruder / sniffer for Linux
 *      (c) 1998-2000 by kra
 */
starting hunt
--- Main Menu --- rcvpkt 0, free/alloc 63/64 -----
l/w/r) list/watch/reset connections
u)      host up tests
a)      arp/simple hijack (avoids ack storm if arp used)
s)      simple hijack
d)      daemons rst/arp/sniff/mac
```

```

o)      options
x)      exit
-> d
--- daemons --- rcvpkt 70, free/alloc 63/64 -----
r) reset daemon
a) arp spoof + arp relay daemon
s) sniff daemon
m) mac discovery daemon
x) return
-dm> r
--- reset daemon --- rcvpkt 148, free/alloc 63/64 -----
s/k)    start/stop daemon
l)      list reset database
a/m/d)  add/mod/del entry
x)      return
-rstd> s
rst daemon started
--- reset daemon --- rcvpkt 218, free/alloc 63/64 ---R---
s/k)    start/stop daemon
l)      list reset database
a/m/d)  add/mod/del entry
x)      return
-rstd> x
--- daemons --- rcvpkt 277, free/alloc 63/64 ---R---
r) reset daemon
a) arp spoof + arp relay daemon
s) sniff daemon
m) mac discovery daemon
x) return
-dm> s
--- sniff daemon --- rcvpkt 557, free/alloc 63/64 ---R---
s/k)    start/stop sniff daemon
l)      list sniff database  c) list sniff connection
a/m/d)  add/mod/del sniff item
o)      options
x)      return
-sniff> l
--- sniff daemon --- rcvpkt 609, free/alloc 63/64 ---R---
s/k)    start/stop sniff daemon
l)      list sniff database  c) list sniff connection
a/m/d)  add/mod/del sniff item
o)      options
x)      return
-sniff> a
src ip addr/mask ports [0.0.0.0/0]> 192.168.1.3
dst ip addr/mask ports [0.0.0.0/0]> 192.86.83.0/24
want to search for y/n [n]> n
log mode [s]rc/[d]st/[b]oth [b]> b
log bytes [64]>
log file name [by conn]> ssh-sniff.txt
insert at [0]>
--- sniff daemon --- rcvpkt 5245, free/alloc 63/64 ---R---
s/k)    start/stop sniff daemon
l)      list sniff database  c) list sniff connection
a/m/d)  add/mod/del sniff item
o)      options
x)      return
-sniff> s
sniffer started
--- sniff daemon --- rcvpkt 5469, free/alloc 63/64 ---RS---
s/k)    start/stop sniff daemon
l)      list sniff database  c) list sniff connection
a/m/d)  add/mod/del sniff item
o)      options
x)      return

```

The only actions done were as follows:

```

> ssh system1.wlk.com
deaves@system1.wlk.com's password:*****

```

```
Last login Tue Dec 11 17:37:30 2001 from 12.236.57.nnn
No mail
Sun Microsystems Inc. SunOS 5.5.1 Generic May 1996
hostname% hello
hello: Command not found
hostname% world
world: Command not found
hostname% exit
hostname% logout
Connection to system1.wlk.com closed
```

And the sniffed result is as follows. Note that even the initial prompts are encrypted using Diffie-Hellman, even before key exchange (after, in boldface).

```
192.168.1.3 [3443] <-- 192.86.83.nnn [22]
SSH-1.5-1.2.26[0xA]<ACTION bytes_logged=15>
```

```
192.168.1.3 [3443] --> 192.86.83.nnn [22]
SSH-1.5-OpenSSH_2.5.2p2[0xA]<ACTION bytes_logged=24>
```

```
192.168.1.3 [3443] <-- 192.86.83.nnn [22]
[0x0][0x0][0x1][0xB][0x0][0x0][0x0][0x0][0x0][0x2]n[0xD1]:v[0xBC][0x91][0xB8][0x81][0x0][
0x0][0x3][0x0][0x0][0x6]%[0x3][0x0][0xBF][0xB3]1[0x8F]E"[0x9D][0xBF][0xA1][0xE6][0x8E][0x
EA][0xCB]=|v[0x17][0xE1]\[0x90][0x14][0x93]1[0x0][0x9F][0x89][0x95][0xD5]1$>[0xB6][0xC5][
0x9E][0xB1][0x10]F[0xBF]) [0x9E][0x89]=| [0xF4]0[0xC2] ([0xCB]h[0x8C][0xA1][0xA6]M[0x15][0x9
3]C[0xCA][0x12]=WJY[0xD6][0xF9][0x7F][0x91][0x9A][0x97]$[0xFF][0xE9][0x98][0xE5][0xEC][0x
A1][0xBE][0x8B][0xB3][0xBC][0xB0][0x9D][0x9C][0xA0][0xE8][0xD8][0xCC][0x83][0xC1]) [0x94][
0xB6][0xC0][0x19][0xE1]Q[0x8D][0x0][0x0][0x4][0x0][0x0][0x6]%[0x4][0x0][0xA8][0xF8][0x98]
[0xE6][0x8F]3[0x87][0xE4][ [0xEC][0xB7][0xCA][0xC3][0xE0][0x8]u[0x2][0xC2][0xA2]Q[0x8A][0x
AE]{7[[0xB5]y6[0xA9][0x89][0x1E][0x4]Q[0x8D]y;[0xA9]I!j[0xE4][0xDA][0x8A][0xDF][0xF0]$RX[
0xF8]b-
[0x86]x[0xCB]tM[0xDF][0xF5][0xA1]o[0xE]`[0x1F][0xA8][0x19][0xCD]R[0x14][0xB][0x1E][0x89]
[0x7F]-
[0xF0]2[0xAE]*CZK[0xE0]CS.[0x9A][0xDB][0xEC]A[0x7F][0x15][0x2]d[0xEE]1[0xFF][0xF][0x9D][
0xB8]W[0xB1]b[0x1E]n[0x14][0xD2]a[0xCA][0xB7][0xE9]y[0xF3][0xEC][0xA0][0x1]p[0xDD]v[0xE0]
*[0x94][0xAA][0xF7][0xAB][0xAA][ [0x0][0x0][0x0][0x2][0x0][0x0][0x0][0x0]N[0x0][0x0][0x0][0x1C
][0xB6][0xBC][0x14][0xF3]<ACTION bytes_logged=276>
```

```
192.168.1.3 [3443] --> 192.86.83.nnn [22]
[0x0][0x0][0x0][0x94][0x0][0x0][0x0][0x0][0x3][0x3]n[0xD1]:v[0xBC][0x91][0xB8][0x81][0x3]
[0xFE]8[0xD2][0x89]e[0x17][0xEC]7[0xC5][0xB8][0xD7]3[0xBA][0xD5][0x83][0x8B]k[0x1E][0xF][
0x1][0x92][0x9E][0xCB]1[0xD6][0x0]tFD[0xDE][0x93][0x83]xT[0x2][0xAC][0xA][0xD6]u[0xD8][0x
EE][0xB7][0xD9][0xE][0xAE][0xF7][0xB3][0xD]f[0xC0][0x0]KP'[0x18][0x0][0xE7][0xDF][0xCA][
0xF8][0xF][0xCE][0x9D][0xDC][0xA1]i[0xF][0xEB]W[0xF7]lBi{&=[0xF7][0xDD]X[0x1E][0xC1][0xB
]M<[0x9D]C[0xE6]cRN[0xA0][0x9B]gW[0xA1][0x1A]d8[0x6][0x8][0x10][0xD3][0xF0]cLX[0xB5][0x9]
[0xDE][0xBD]/[0x14][0xDE][0xA6]v
[0xC6]s)v[0x96]) [0xEE][0x8A][0xD9]@[0xD3][0x0][0x0][0x0][0x3][0xC4]] [0x81][0x11]<ACTION
bytes_logged=156>
```

```
192.168.1.3 [3443] <-- 192.86.83.nnn [22]
[0x0][0x0][0x0][0x5][0x83]Cx[0xC9][0xC6]A[0xA5][0xAD]<ACTION bytes_logged=12>
```

```
192.168.1.3 [3443] --> 192.86.83.nnn [22]
[0x0][0x0][0x0][0xF][0xE7][0xD7][0xCA][0xA1][0x1D][0xF5]%[0x7F]8V[0xC4][0xE3][/[0xF3][0xC
E]<ACTION bytes_logged=20>
```

```
192.168.1.3 [3443] <-- 192.86.83.nnn [22]
[0x0][0x0][0x0][0x5]E[0x7]$[0x12][0xCC][0xCD]tm<ACTION bytes_logged=12>
```

```
192.168.1.3 [3443] --> 192.86.83.nnn [22]
[0x0][0x0][0x0]) [0xC8][0xDF][0x1A][0xF9][0xC1]r[0x8A][0x8A][0x93][0xEF][0xB8][0x9A][0x0]Z
8[0xC3][0xB5]] [0x13][0xA3][0xAF]/[0xB7]k[0xA0]srV[0xFD][0xD7][0xB9]hP[0xD]2[0xC]M[0x9][0x
9A][0x98][0xE4][0x9][0x93][0xE0][0x1][0x85][0x8A][0x8]<ACTION bytes_logged=52>
```

```
192.168.1.3 [3443] <-- 192.86.83.nnn [22]
[0x0][0x0][0x0][0x5][0x14][0x81][0xC5][0xB1][0x17][0x0]c9<ACTION bytes_logged=12>
```

```
192.168.1.3 [3443] --> 192.86.83.nnn [22]
[0x0][0x0][0x0][0x8B]57[0x7][0x8A][0x19]ON#[0x9E][0xF1][0x1C]#[0xF7][0x1F]voh[0xEF]B[0xA9
]Y[0x10]'[0xAD][0xAF][0xCB]^[0xD7]D[0xA][0x14]Mf[0xE8]'[0x17]q[0x89][0x7][0x84][0x83]>[0x
```

F2] [0xB6]K[0x15] [0x93]P{ [0xB4]kH[0xF2] [0x11]p[0xDC]Ml[0xEE] [0xBF]+jQ[0x9] [0xB9] [0xA0]` [0xB9] [0xEA] [0xD0] [0xD3] [0xD1]f[0x83] [0xED] [0x5] [0xD2] [0xF7] [0x1F]0[0x9B] [0xB0] [0xF1]sP[0xA8] [0xC4] [0xD] [0xF] [0xAA] [0xC7]%>[0xF2]}%n[0x17]9[0x86]! [0xAB] [0xA7]Q[0x13] [0x88] [0xA6]v[0x8B] [0xA7] [0x9] [0xA2] [0xE0] [0x9]scu[0xE3]N[0x95] [0x9D]CD`FS[0xEE]{. [0xDD] [0xA] [0xD1] [0xC5]BYBz[0xFA]' [0x1F] [0xDC]q[0xBC] [0xDD]<ACTION bytes\_logged=148>

192.168.1.3 [3443] <-- 192.86.83.nnn [22]  
[0x0] [0x0] [0x0] [0x5]m[0xC9] [0xAE]0[0x97] [0x99]>[0x86]<ACTION bytes\_logged=12>

192.168.1.3 [3443] --> 192.86.83.nnn [22]  
[0x0] [0x0] [0x0]Cjx[0xDE] [0x1D]G[0xDC] [0xED] [0x9B]n[0xBA] [0xA2] [0xD1]C[0xF9] [0xA6]F[0xF8] [0xE7] [0xD4] [0x9] [0xA5]J[0xE0] [0xFA]%[0x18] [0x6] [0x83]g[0x6] [0x93] [0x2] [0x8E]! [0xC2] [0xC8] [0x1D] [0xA5]e[0x15] [0xF2]\_ [0xAB]0[0x86] [0xF2] [0xBD] ([0x90] [0x8A] [0xC1]U6[0xF4] [0x16] [0xA0]\$m8o[0x97] [0x85] [0xAC] [0xF7]h/[0x85]o[0x9D]<ACTION bytes\_logged=76>

192.168.1.3 [3443] <-- 192.86.83.nnn [22]  
[0x0] [0x0] [0x0] [0x5]\[0x7]\_ [0xD7] [0x10] [0xFD] [0x7] [0x10]<ACTION bytes\_logged=12>

192.168.1.3 [3443] --> 192.86.83.nnn [22]  
[0x0] [0x0] [0x0] [0x5] [0xCB] [0xE4] [0xE3] [0xEF] [0x1D] [0xC7] [0xB4]~<ACTION bytes\_logged=12>

192.168.1.3 [3443] <-- 192.86.83.nnn [22]  
[0x0] [0x0] [0x0]C%[0xDB]uU[0x14] [0x8E] [0x89] [0xE0] ([0x9F]?[0x91] [0x4] [0x81]o[0x19] [0xCB] [0xC2]Rw[0xFB] [0xA4] [0xB5] [0xD] [0x8E]2R[0xAC] [0xB3] [0x14] [0xDB]zo1[0x9E]X[0xF0] [0xFC] [0xEB] [0x93]3[0x8B]. [0xBE] ]pH[0xE2]%[0xF]R9[0x95] [0x11] [0xBD] [0xFD] [0x3] [0x0]\_ [0x8] [0xF9] { [0x16] [0x8E], [0x1C] [0x17] [0xBA]=[0x85] [0xE7] [0xB7]<ACTION bytes\_logged=76>

192.168.1.3 [3443] <-- 192.86.83.nnn [22]  
[0x0] [0x0] [0x0] [0x13] [0xD6] [0xBE]F[0x9F]A[0xA] [0x8D] [0xC]U[0x2] [0xBE]O[0xF0]f1[0xD9] [0xD5] [0xE3]M[0x94] [0xC1]P[0x1D] [0xCB] [0x0] [0x0] [0x0]C[0x92]J[0xB4] [0xAB] [0x1F] [0xDB] [0x2] { [0x7F]L[0xB2]8[0xB8] [0xAE]z: [0xB] [0x88]E/[0x88] [0xAA]h[0xE1]!p0z[0xF4] [0x88]Q[0x12] [0xC7] [0xD6] [0xAC]\_ [0xC3] [0xF4] [0xDD] [0x95] [0xC4] [0xFB] [0xF7]c[0xC7] [0x7F] [0x10]O6- [0x7]U[0x1F]Y[0x96] [0x18] [0xE6] [0xCA] [0xB1] [0xC2]44"[0xE3] [0xF4].0[0xC2] [0xB4] [0x86]' [0xF6]<ACTION bytes\_logged=104>

192.168.1.3 [3443] <-- 192.86.83.nnn [22]  
[0x0] [0x0] [0x0] [0x13] [0xC2]Hj| [0x1C] [0xD2] [0x11]y;kF[0xFF]|3[0xF] [0xAE]K.J&[0xFA] [0x1A]n[0x1B]<ACTION bytes\_logged=28>

192.168.1.3 [3443] --> 192.86.83.nnn [22]  
[0x0] [0x0] [0x0] [0xA] [0x6] [0xB0] [0xA]k[0xA0] [0xD5]HP[0xA2] [0xC3]D! [0xB] [0xB9]Y[0xDD] [0x0] [0x0] [0x0] [0xA]u[0x91] [0xD5] [0x9] [0xA3]; [0x7] [0xB1]K[0x96] [0x17] [0xEC] [0x12]1[0x1] [0xC]<ACTION bytes\_logged=40>

192.168.1.3 [3443] <-- 192.86.83.nnn [22]  
[0x0] [0x0] [0x0] [0xA] [0xEA]c[0xC7] [0x8E] [0x15] [0xD5]2[0xFE] { [0xF6] [0xF1]3[0xB7] [0xA3] [0x8A] ]1[0x0] [0x0] [0x0] [0xA]im[0x16] [0xFF] [0x90] [0xD9] [0xED] [0xC3] [0x8F]G[0xDF] [0x12] [0xF6]F[0xD5]+<ACTION bytes\_logged=40>

192.168.1.3 [3443] --> 192.86.83.nnn [22]  
[0x0] [0x0] [0x0] [0xA] [0x1E] [0x5] [0xCE] [0x6] [0x9D]RJLJ=4[0x8B]B[0xD]/ [0xD5]<ACTION bytes\_logged=20>

192.168.1.3 [3443] <-- 192.86.83.nnn [22]  
[0x0] [0x0] [0x0] [0xA] [0xC4]M[0xE8]' [0xA2] [0x8B]5N[0xB3]4[0xC6]^ [0x94]h[0xED]V<ACTION bytes\_logged=20>

192.168.1.3 [3443] --> 192.86.83.nnn [22]  
[0x0] [0x0] [0x0] [0xA] [0xC2]VB[0xB3]fs[0xCF]I [0xEB] [0xE2] [0xF8]L\$ [0xB9] [0xA3] [0x9A]<ACTION bytes\_logged=20>

192.168.1.3 [3443] <-- 192.86.83.nnn [22]  
[0x0] [0x0] [0x0] [0xA] [0xE6] [0x97] [0xB7] [0xC7]J[0x0] [0x14]G[0x15] [0x84] [0xE] [0x9F] [0x9D] [0x9] [0xB7] [0x96]<ACTION bytes\_logged=20>

192.168.1.3 [3443] --> 192.86.83.nnn [22]  
[0x0] [0x0] [0x0] [0xA] [0x8E]<[0xF7] [0xA]C[0x7] [0xF7] [0xB]t[0xF9] [0xF2]G[0xD7]D[0xA9]d<ACTION bytes\_logged=20>

192.168.1.3 [3443] <-- 192.86.83.nnn [22]



```

[0x0][0x0][0x0][0xA][0xB][0x6][0xD]u=[0xEB]]X"O,p[0x8][0x19][0x80]<ACTION
bytes_logged=20>

192.168.1.3 [3443] --> 192.86.83.nnn [22]
[0x0][0x0][0x0][0xA][0xD7][0xCB][0xF1]7[0xF][0xC0][0xC8][0xE0][0x0]yq##&[0xFD]<ACTION
bytes_logged=20>

192.168.1.3 [3443] <-- 192.86.83.nnn [22]
[0x0][0x0][0x0]/[0x8A][0xA2]i[0x7F]FW[0xB8]o[0xB7][0xAA]|[0xA4]l2[0xE3]A([0xF)[0x8F][0xE4
][0xA1][0xDC][0xB8][0x9F]f[0xC8]G
[0xF1]?[0x16]#[0x83][0xCD][0x9C][0xB1][0xC8][0xF][0xB8][0xE6][0xCE]fsA[0xDB][0xCB]I'<ACTI
ON bytes_logged=52>

192.168.1.3 [3443] --> 192.86.83.nnn [22]
[0x0][0x0][0x0][0xA][0xB5]&[0xDE]a [0x17]z[0x91][0xE]-
}[0xAF][0x6][0x96]2[0xEF][0x0][0x0][0x0][0xA]??[0xC][0x9C][0xCC][0x8A]I[0x2]f[0x9E]/[0xE2
][0xA4][0xE2][0xB6][0xD1]<ACTION bytes_logged=40>

192.168.1.3 [3443] <-- 192.86.83.nnn [22]
[0x0][0x0][0x0][0xA][0xE6][0xC3]}zk[0xCC][0xD2][0xAB][0xA3]Z[0xBB]}[0xA1]P[0xE5][0xA8][0x
0][0x0][0x0][0xA][0xE1]X[0xE5][0x85]([0xAE][0x7F]G[0x98]q[0x4][0xCB][0xB2][0xE7]\U<ACTION
bytes_logged=40>

192.168.1.3 [3443] --> 192.86.83.nnn [22]
[0x0][0x0][0x0][0xA]w[0xF7]y[0xA6][0xC9][0xEF][0x6][0xD2][0xC0][0xE1][0xC5][0xC5][0xB6]*[
0xC]&[0x0][0x0][0x0][0xA]\[0xD9][0xB5][0x15][0xC7]7[0x1B][0x8E][0x1A][0xBE]8b[0xC0]5[0x1B
][0xD9]<ACTION bytes_logged=40>

192.168.1.3 [3443] <-- 192.86.83.nnn [22]
[0x0][0x0][0x0][0xA]-
[0xCA][0xA9][0xAB][0xDF]f[0xCF][0x86][0x9F]w[0x81]~9[0xB1]H[0x93][0x0][0x0][0x0][0xA][0x9
C]6[0xA4]U>F8)n[0xF8][0x8C]C[0xCD]0[0x15][0xB]<ACTION bytes_logged=40>

192.168.1.3 [3443] --> 192.86.83.nnn [22]
[0x0][0x0][0x0][0xA]BdQ[0x98][0xF4]`[0x97]V-[0x1F]b[0x94][0x97]"G[0xAA]<ACTION
bytes_logged=20>

192.168.1.3 [3443] <-- 192.86.83.nnn [22]
[0x0][0x0][0x0][0x0]/K[0xCF]
,[0xDD][0x1C][0x1D][0x1E][0xB6]l[0xF0][0xE5][0x85]&Q[0xC0][0x9A];[0xB]:D[0x11]5[0x1D][0xB
0][0xC8][0xEF][0xBD]\[0x83][0x8B][0xA4][0x94][0xAD].[0xED][0xA2][0xD8]{[0xF6][0xD8]u[0xB6
][0xA1]f[0x12][0xDC][0xF5]<ACTION bytes_logged=52>

192.168.1.3 [3443] --> 192.86.83.nnn [22]
[0x0][0x0][0x0][0xA]w[0xEE][0xAB][0xB4][0x6]+[0x9F]e[0xE9]@[0xD7]5[0x4][AR[0x0][0x0][0x0]
[0xA].[0xC5]{[0xD][0xB7]M}[0x15][0xC0]9[0x88][0xEB]-
D|[0x1F][0x0][0x0][0x0][0xA]w[0xEE][0xAB][0xB4][0x6]+[0x9F]e[0xE9]@[0xD7]5[0x4][AR[0x0][0
x0][0x0][0xA].[0xC5]{[0xD][0xB7]M}[0x15][0xC0]9[0x88][0xEB]-D|[0x1F]<ACTION
bytes_logged=80>

192.168.1.3 [3443] <-- 192.86.83.nnn [22]
[0x0][0x0][0x0][0xA][0xDB][0xD7][0xFA][0x9B][0xE]R[0xAE][0xEB]lt[0xD1][0xD1]m[0xE0]A[0x12
][0x0][0x0][0x0][0xA][0x93]j[0xB2][0xF9]'7R[0xCC][0xF2][0xC2]|[0xE9][0x94][0x97][0xA5]2<A
CTION bytes_logged=40>

192.168.1.3 [3443] --> 192.86.83.nnn [22]
[0x0][0x0][0x0][0xA]p[0xD3]([0xA][0xAA][0x94][0x88][0xA6][0xCB][0xFC][0x7F][0xB0]_[0xFD][
0x98][0xA8]<ACTION bytes_logged=20>

192.168.1.3 [3443] <-- 192.86.83.nnn [22]
[0x0][0x0][0x0][0xA]M|[0x6][0x7]S4[0xC3}%w}[0xE1][0x86][0xCF],[0x8D][0xF9]<ACTION
bytes_logged=20>

192.168.1.3 [3443] --> 192.86.83.nnn [22]
[0x0][0x0][0x0][0xA][0xAD]k[0xA8][0xB9]@[0x6]l[0xFA]Cy[0xB8][0xD4]e_[0xC4]5<ACTION
bytes_logged=20>

192.168.1.3 [3443] <-- 192.86.83.nnn [22]
[0x0][0x0][0x0][0xA][0xF6][0xC6]s+[0x2][0xC6][0xAD]w3[0xDA]sS[0x5][0x83][0xBD][0xE]<ACTIO
N bytes_logged=20>

```

```
192.168.1.3 [3443] <-- 192.86.83.nnn [22]
[0x0][0x0][0x0][0x1D][0x4][0xCD]J[0xA0][0xEA)]![0x3]j[0x87][0xB6][0x87]0[0xD9][0xB0][0x82]
[0x99][0x84][0x15]4T[0xDC][0xB6](*W[0xA1]a[0x3][0xD2]G'[0x0][0x0][0x0][0x9][0xFC]f-
Q[0xAD][0x82][0xF1][0xCF]7u[0x80]g[0x88][0x9D]@[0xB2]<ACTION bytes_logged=56>
```

```
192.168.1.3 [3443] --> 192.86.83.nnn [22]
[0x0][0x0][0x0][0x5][0xD8]y[0xCF]KG[0xBF][0xB]G<ACTION bytes_logged=12>
```

Pass: SSH appears to be actually secure, mostly unprintable characters.

Server request logs are monitored and responded to: Pass – web access logs are distributed daily to clients. Traffic is relatively low, less than twenty independent hits per day, which allows informal usage adaptation, and DoS and surveillance detection. The automated traffic based DoS prevention system seems likely to protect against any but a widely distributed DoS attack.

Scoring note: Since there are no secure features, checklist items involving HTTPS, authentication, and cookies should not be counted in the scoring denominator.

Summary of Remedies, in order of subjective estimate of cost/time, and triaged:

Actions taken during the course of the audit:

- 1) Directory viewing turned off for [www.<web\\_site\\_name>.com](http://www.<web_site_name>.com)

Remedial actions to be taken:

- 2) Scan Apache for Apache 1.2.6 specific vulnerabilities
- 3) Update Apache and/or obscure its banner
- 4) Correctly place the robots.txt file
- 5) Remove quick-response-form.html comments
- 6) Compress/obfuscate HTML and form variables

Lower priority:

- 7) Run Solaris CIS ruler for added internal security assurance
- 8) Update SSH

Final Audit for Remote system #1 was conducted December 12, 2001, and no claim is made here for the condition of this system on any date after that.

Supporting matrixes for risk mitigation analysis follow:

Failed checklist items represent risks of damage, times annual frequency/likelihood of a related exploit that could otherwise be prevented. These are subjective estimates provided by the management, whose assistance was invaluable in preparing this report.

	Scan Apache: Apache exploits	Update/obscure Apache: Apache exploits	Robots.txt: Crawlers, DoS, surveillance	Remove comments: Surveillance	Compress HTML: Surveillance
Remote system #1	1.0	1.0	0.1	0.1	0.1

Assumptions are that use of known Apache exploits is common and frequent, and when used that they can give root access, with possibility of root kit and system compromise if successful. Surveillance involves relatively minimal harm/disclosure, although it could occur frequently. Crawlers can also increase legitimate site traffic, which mitigates the risks from surveillance. It is unknown here whether there are any known Apache 1.2.6 exploits that were only fixed in subsequent Apache versions and never patched in 1.2.6. This represents a research project outside the scope of this IT audit. Alternatively the Apache version could simply be updated.

## Appendix E: Benchmark and Matrixes, Remote system #2

The assessment of remote system #2 includes a checklist-of-checklists for the system generally. The system hosts email services here for Generic Services Corporation, and runs both IMAP and SMTP services. There should be, as described in Part I, an internal vulnerability scan using the CIS Solaris ruler, an external vulnerability scan conducted using nessus from the local system, and a sniff of the actual IMAP sessions to make sure they do not disclose anything inappropriate in plaintext.

The CIS Solaris ruler measurement (internal vulnerability report):

The network owner was reticent to allow permission for such an internal procedure to be run, considering that it requires root access to be made and executed. Not pass.

SSH/IMAP/SMTP host (IP ending octets edited out):

Nessus Scan Report  
-----

### SUMMARY

- Number of hosts which were alive during the test : 1
- Number of security holes found : 0
- Number of security warnings found : 3
- Number of security notes found : 3

### TESTED HOSTS

192.86.83.nnn (Security warnings found)

### DETAILS

- + 192.86.83.nnn :
  - . List of open ports :
    - o general/udp (Security notes found)
    - o ssh (22/tcp) (Security warnings found)
    - o telnet (23/tcp) (Security notes found)
    - o smtp (25/tcp) (Security warnings found)
    - o general/tcp (Security warnings found)
  - . Information found on port general/udp
  - . For your information, here is the traceroute to 192.86.83.nnn :
    - ?
  - . Warning found on port ssh (22/tcp)

You are running a version of SSH which is older than (or as old as) version 1.2.27.

If you compiled ssh with kerberos support, then an attacker may eavesdrop your users kerberos tickets, as sshd will set the environment variable KRB5CCNAME to 'none', so kerberos tickets will be stored

in the current working directory of the user, as 'none'.

If you have nfs/smb shared disks, then an attacker may eavesdrop the kerberos tickets of your users using this flaw.

\*\* If you are not using kerberos, then ignore this warning.

Risk factor : Serious  
Solution : use ssh 1.2.28 or newer  
CVE : CAN-2000-0575

. Information found on port telnet (23/tcp)

Remote telnet banner :  
ÿ-\$

. Warning found on port smtp (25/tcp)

The remote SMTP server is vulnerable to a redirection attack. That is, if a mail is sent to :

user@hostname1@victim

Then the remote SMTP server (victim) will happily send the mail to :

user@hostname1

Using this flaw, an attacker may route a message through your firewall, in order to exploit other SMTP servers that can not be reached from the outside.

\*\*\* THIS WARNING MAY BE A FALSE POSITIVE, SINCE  
SOME SMTP SERVERS LIKE POSTFIX WILL NOT  
COMPLAIN BUT DROP THIS MESSAGE \*\*\*

Solution : if you are using sendmail, then at the top of ruleset 98, in /etc/sendmail.cf, insert :  
R\$\*@\$\*@\$\* \$#error \$@ 5.7.1 \$: '551 Sorry, no redirections.'

Risk factor :  
Low

. Information found on port smtp (25/tcp)

Remote SMTP server banner :  
0  
220-system2.WLK.Com[192.86.83.nnn] SPAM is not welcome220 ESMTP spoken here.

214-Commands

214-HELO EHLO MAIL RCPT RSET ONEX

214 VERB DATA NOOP QUIT HELP VERB

. Warning found on port general/tcp

The remote host uses non-random IP IDs, that is, it is

possible to predict the next value of the ip\_id field of the ip packets sent by this host.

An attacker may use this feature to determine if the remote host sent a packet in reply to another request. This may be used for portscanning and other things.

Solution : Contact your vendor for a patch

Risk factor :

Low

-----  
This file was generated by the Nessus Security Scanner

Pass: Unexpectedly, SSH was found operating on this machine as well as the designated SSH host on remote system #1. However, it appears to be the same version of SSH as remote system #1 and passes on the same criteria. A sniffed SSH session is shown in the last checklist, to compare to the sniffed IMAP session originally called for.

And the sniffed result is as follows. Note that the password exchange (boldface) appears to be at least hashed, if not strongly encrypted, although the contents are not encrypted using IMAP only for authentication. This is a simple email authentication and download:

```
192.168.1.3 [3604] <-- 192.86.83.250 [143]
* OK news IMAP4rev1 v12.264 server ready[0xD][0xA]<ACTION bytes_logged=22>

192.168.1.3 [3604] --> 192.86.83.250 [143]
00000000 CAPABILITY[0xD][0xA]<ACTION bytes_logged=21>

192.168.1.3 [3604] <-- 192.86.83.250 [143]
* CAPABILITY IMAP4 IMAP4REV1 NAMESPACE IDLE SCAN SORT MAILBOX-REFERRALS LOGIN-REFERRALS
AUTH=LOGIN THREAD=ORDEREDSUBJECT[0xD][0xA]00000000 OK CAPABILITY
completed[0xD][0xA]<ACTION bytes_logged=156>

192.168.1.3 [3604] --> 192.86.83.250 [143]
00000001 AUTHENTICATE LOGIN[0xD][0xA]<ACTION bytes_logged=29>

192.168.1.3 [3604] <-- 192.86.83.250 [143]
+ VXNlciBOYWllAA==[0xD][0xA]<ACTION bytes_logged=20>

192.168.1.3 [3604] --> 192.86.83.250 [143]
ZGVldmVz[0xD][0xA]<ACTION bytes_logged=10>

192.168.1.3 [3604] <-- 192.86.83.250 [143]
+ UBZzc3dvcnQA[0xD][0xA]<ACTION bytes_logged=16>

192.168.1.3 [3604] --> 192.86.83.250 [143]
TGFFcC2BSQjg7Lg==[0xD][0xA]<ACTION bytes_logged=18>

192.168.1.3 [3604] <-- 192.86.83.250 [143]
00000001 OK AUTHENTICATE completed[0xD][0xA]<ACTION bytes_logged=36>

192.168.1.3 [3604] --> 192.86.83.250 [143]
00000002 CAPABILITY[0xD][0xA]<ACTION bytes_logged=21>

192.168.1.3 [3604] <-- 192.86.83.250 [143]
* CAPABILITY IMAP4 IMAP4REV1 NAMESPACE IDLE SCAN SORT MAILBOX-REFERRALS LOGIN-REFERRALS
AUTH=LOGIN THREAD=ORDEREDSUBJECT[0xD][0xA]00000002 OK CAPABILITY
completed[0xD][0xA]<ACTION bytes_logged=156>

192.168.1.3 [3604] --> 192.86.83.250 [143]
00000003 SELECT INBOX[0xD][0xA]<ACTION bytes_logged=23>

192.168.1.3 [3604] <-- 192.86.83.250 [143]
```

```

* 36 EXISTS[0xD][0xA]* 0 RECENT[0xD][0xA]* OK [UIDVALIDITY 995566850] UID validity
status[0xD][0xA]* OK [UIDNEXT 379] Predicted next UID[0xD][0xA]* FLAGS (\Answered
\Flagged \Deleted \Draft \Seen)[0xD][0xA]* OK [PERMANENTFLAGS (\* \Answered \Flagged
\Deleted \Draft \Seen)] Permanent flags[0xD][0xA]00000003 OK [READ-WRITE] SELECT
completed[0xD][0xA]<ACTION bytes_logged=294>

192.168.1.3 [3604] --> 192.86.83.250 [143]
00000004 FETCH 1:36 (UID INTERNALDATE RFC822.SIZE FLAGS)[0xD][0xA]<ACTION
bytes_logged=58>

192.168.1.3 [3604] <-- 192.86.83.250 [143]
* 1 FETCH (UID 253 INTERNALDATE " 1-Nov-2001 09:09:00 -0600" RFC822.SIZE 5554 FLAGS
(\Seen))[0xD][0xA]* 2 FETCH (UID 258 INTERNALDATE " 2-Nov-2001 19:30:20 -0600"
RFC822.SIZE 5499 FLAGS (\Seen))[0xD][0xA]* 3 FETCH (UID 259 INTERNALDATE " 2-Nov-2001
19:42:07 -0600" RFC822.SIZE 2471 FLAGS (\Seen \Answered))[0xD][0xA]* 4 FETCH (UID 266
INTERNALDATE " 5-Nov-2001 16:22:12 -0600" RFC822.SIZE 17881 FLAGS (\Seen))[0xD][0xA]* 5
FETCH (UID 269 INTERNALDATE " 6-Nov-2001 15:49:32 -0600" RFC822.SIZE 3630 FLAGS
(\Seen))[0xD][0xA]* 6 FETCH (UID 272 INTERNALDATE " 7-Nov-2001 13:38:10 -0600"
RFC822.SIZE 32752 FLAGS (\Seen))[0xD][0xA]* 7 FETCH (UID 273 INTERNALDATE " 7-Nov-2001
16:15:16 -0600" RFC822.SIZE 14828 FLAGS (\Seen))[0xD][0xA]* 8 FETCH (UID 276 INTERNALDATE
" 8-Nov-2001 15:15:25 -0600" RFC822.SIZE 19811 FLAGS (\Seen))[0xD][0xA]* 9 FETCH (UID 280
INTERNALDATE " 9-Nov-2001 09:32:16 -0600" RFC822.SIZE 3073 FLAGS (\Seen))[0xD][0xA]* 10
FETCH (UID 281 INTERNALDATE " 9-Nov-2001 19:36:36 -0600" RFC822.SIZE 7011 FLAGS (\Seen
\Answered))[0xD][0xA]* 11 FETCH (UID 282 INTERNALDATE " 9-Nov-2001 21:19:52 -0600"
RFC822.SIZE 25116 FLAGS (\Seen))[0xD][0xA]* 12 FETCH (UID 285 INTERNALDATE "10-Nov-2001
13:04:48 -0600" RFC822.SIZE 3203 FLAGS (\Seen))[0xD][0xA]* 13 FETCH (UID 290 INTERNALDATE
"12-Nov-2001 16:09:08 -0600" RFC822.SIZE 5422 FLAGS (\Seen))[0xD][0xA]* 14 FETCH (UID 291
INTERNALDATE "12-Nov-2001 19:48:22 -0600" RFC822.SIZE 14231 FLAGS (\Seen))[0xD][0xA]* 15
FETCH (UID 294 INTERNALDATE "13-Nov-2001 09:55:12 -0600" RFC822.SIZE 5399 FLAGS
(\Seen))[0xD][0xA]* 16 FETCH (UID 29<ACTION bytes_logged=1460>

192.168.1.3 [3604] <-- 192.86.83.250 [143]
7 INTERNALDATE "14-Nov-2001 11:20:00 -0600" RFC822.SIZE 19729 FLAGS (\Seen))[0xD][0xA]*
17 FETCH (UID 298 INTERNALDATE "14-Nov-2001 14:54:49 -0600" RFC822.SIZE 2903 FLAGS (\Seen
\Answered))[0xD][0xA]* 18 FETCH (UID 299 INTERNALDATE "14-Nov-2001 19:19:24 -0600"
RFC822.SIZE 4181 FLAGS (\Seen \Answered))[0xD][0xA]* 19 FETCH (UID 302 INTERNALDATE "15-
Nov-2001 12:49:42 -0600" RFC822.SIZE 2062 FLAGS (\Seen))[0xD][0xA]* 20 FETCH (UID 305
INTERNALDATE "15-Nov-2001 15:21:42 -0600" RFC822.SIZE 15767 FLAGS (\Seen))[0xD][0xA]* 21
FETCH (UID 318 INTERNALDATE "20-Nov-2001 14:46:52 -0600" RFC822.SIZE 10423 FLAGS
(\Seen))[0xD][0xA]* 22 FETCH (UID 321 INTERNALDATE "21-Nov-2001 16:31:45 -0600"
RFC822.SIZE 7712 FLAGS (\Seen))[0xD][0xA]* 23 FETCH (UID 322 INTERNALDATE "21-Nov-2001
16:52:52 -0600" RFC822.SIZE 17877 FLAGS (\Seen))[0xD][0xA]* 24 FETCH (UID 327
INTERNALDATE "23-Nov-2001 08:46:45 -0600" RFC822.SIZE 12220 FLAGS (\Seen))[0xD][0xA]* 25
FETCH (UID 332 INTERNALDATE "25-Nov-2001 16:42:41 -0600" RFC822.SIZE 3113 FLAGS (\Seen
\Answered))[0xD][0xA]* 26 FETCH (UID 337 INTERNALDATE "27-Nov-2001 19:37:35 -0600"
RFC822.SIZE 7342 FLAGS (\Seen))[0xD][0xA]* 27 FETCH (UID 340 INTERNALDATE "28-Nov-2001
15:30:51 -0600" RFC822.SIZE 16336 FLAGS (\Seen))[0xD][0xA]* 28 FETCH (UID 341
INTERNALDATE "28-Nov-2001 17:19:39 -0600" RFC822.SIZE 3614 FLAGS (\Seen
\Answered))[0xD][0xA]* 29 FETCH (UID 344 INTERNALDATE "29-Nov-2001 19:16:39 -0600"
RFC822.SIZE 15217 FLAGS (\Seen))[0xD][0xA]* 30 FETCH (UID 345 INTERNALDATE "29-Nov-2001
19:53:50 -0600" RFC822.SIZE 19528 FLAGS (\Seen))[0xD][0xA]* 31 <ACTION bytes_logged=1460>

192.168.1.3 [3604] <-- 192.86.83.250 [143]
FETCH (UID 348 INTERNALDATE "30-Nov-2001 17:02:33 -0600" RFC822.SIZE 39043 FLAGS
(\Seen))[0xD][0xA]* 32 FETCH (UID 359 INTERNALDATE " 5-Dec-2001 09:53:59 -0600"
RFC822.SIZE 15598 FLAGS (\Seen))[0xD][0xA]* 33 FETCH (UID 362 INTERNALDATE " 6-Dec-2001
15:38:44 -0600" RFC822.SIZE 20999 FLAGS (\Seen))[0xD][0xA]* 34 FETCH (UID 373
INTERNALDATE "11-Dec-2001 08:36:22 -0600" RFC822.SIZE 3059 FLAGS (\Seen))[0xD][0xA]* 35
FETCH (UID 375 INTERNALDATE "11-Dec-2001 18:02:58 -0600" RFC822.SIZE 6586 FLAGS
(\Seen))[0xD][0xA]* 36 FETCH (UID 378 INTERNALDATE "12-Dec-2001 12:55:15 -0600"
RFC822.SIZE 12339 FLAGS (\Seen))[0xD][0xA]00000004 OK FETCH completed[0xD][0xA]<ACTION
bytes_logged=598>

192.168.1.3 [3604] --> 192.86.83.250 [143]
00000005 FETCH 1,2:21 (ENVELOPE BODY.PEEK[HEADER.FIELDS (Path Message-ID Content-Type
Newsgroups Followup-To References)] FLAGS)[0xD][0xA]<ACTION bytes_logged=130>

192.168.1.3 [3604] <-- 192.86.83.250 [143]
* 1 FETCH (ENVELOPE ("1 Nov 2001 10:07:14 -0500" "48 hours left to SAVE for LinuxWorld
Conference & Expo!" ("LinuxWorld" NIL "J24049-R19414" "igmailer.net")) ("LinuxWorld"
NIL "J24049-R19414" "igmailer.net")) ((NIL NIL "J24049-R19414" "igmailer.net")) ((NIL NIL

```

```
"deaves" "internet-security-corp.com")) NIL NIL NIL
"<CRISMTp4E2FGwQ21ju200005df3@mail4.iqmail.net>") BODY[HEADER.FIELDS ("PATH" "MESSAGE-
ID" "CONTENT-TYPE" "NEWSGROUPS" "FOLLOWUP-TO" "REFERENCES")] {112}[0xD][0xA]Content-Type:
text/plain; charset="iso-8859-1"[0xD][0xA]Message-ID:
<CRISMTp4E2FGwQ21ju200005df3@mail4.iqmail.net>[0xD][0xA][0xD][0xA] FLAGS
(\Seen)[0xD][0xA]* 2 FETCH (ENVELOPE ("Fri, 2 Nov 2001 20:27:36 -0500 (EST)" "Re:
Surveillance from VNCyber -- no permission -- illegal (B-TSI-004021748)" ("UUNET
Internet Abuse Investigations" NIL "nobody" "UU.NET")) ("UUNET Internet Abuse
Investigations" NIL "nobody" "UU.NET")) ((NIL NIL "nobody" "UU.NET")) ("David M Eaves"
NIL "deaves" "internet-security-corp.com")) NIL NIL {96}[0xD][0xA]Your message of "Fri, 2
Nov 2001 11:48:38 -0800 (PST)" <<20011102194847.04B5925ED@news.wlk.com>>
"<Qqlnmb15779.200111030127@iaremedy.corp.us.uu.net>") BODY[HEADER.FIELDS ("PATH"
"MESSAGE-ID" "CONTENT-TYPE" "NEWSGROUPS" "FOLLOWUP-TO" "REFERENCES")]
{66}[0xD][0xA]Message-Id:
<Qqlnmb15779.200111030127@iaremedy.corp.us.uu.net>[0xD][0xA][0xD][0xA] FLAGS
(\Seen)[0xD][0xA]* 3 FETCH (ENVELOPE ("Fri, 2 Nov 2001 19:41:52 -0600 (CST)" "Re: Can I
pick your brain a sec?" ("Bob_Tracy" NIL "rct" "yowza.bogus1.wlk.com")) ("Bob_T<ACTION
bytes_logged=1460>
```

etc...

Pass: IMAP by itself, without SSH, does not encrypt email, only authenticates securely.

Summary of Remedies, in order of subjective estimate of cost/time, and triaged:

Remedial actions to be taken:

1. Update IMAP to more secure version

Lower priority:

2. Run Solaris CIS ruler for added internal security assurance
3. Update SSH

Final Audit for Remote system #2 was conducted December 13, 2001, and no claim is made here for the condition of this system on any date after that.

Supporting matrixes for risk mitigation analysis follow:

Failed checklist items represent risks of damage, times annual frequency/likelihood of a related exploit that could otherwise be prevented. These are subjective estimates provided by the management, whose assistance was invaluable in preparing this report.

	Update IMAP: IMAP exploits
Remote system #2	0.05

Assumptions are that this single source of vulnerability involves compromising one or more upstream routers to perform a man-in-the-middle attack, spoofing the source IP address to be able to pass through the firewall, provisioned per POPn/IMAP client IP address. This is unlikely, although if it were possible, a simple IMAP overflow exploit could gain access; further root or privileged access is unknown and would likely be protected. Updating imapd would not significantly mitigate risks to email information, given that it can be sniffed anyway if not additionally encrypted.

## Appendix F: Overall Value-at-Risk Mitigation Matrix

The assets are from Part II, The Audit, section C, the list of IT assets. The assets by systems matrix is shown here, **O**. (Matrix math done in Excel)

		System A1	System A2	System A3	System A4	Sum of A1
Product development code property	\$4000K	100	1	0	0	0
Service Contract with Indian specific charges and	\$250K	"	100	0	"	"
Email records with strategy and shareholder	\$1,000K	0.00	1	0	0	0.00
Website HTML and CSS code design	\$1000K	0	1	0	100	0
Server system logs and user system logs	\$100K	100	1	0	"	"
IT system integrity documents	\$1000K	100	1	0	0	0
Facilities and related facilities security information	\$1,000K	100	100	0	"	"
Finance accounting system, HR, and other administrative	\$1000K	50	1	50	0	0
Website announcement system for controlled access and	\$250K	"	1	0	250	"
Enterprise private network	\$100K	0	1	0	0	0
On-site IT facilities and related facilities	\$400K	0	1	100	0	0
Desktop PCs and software	\$20K	1	1	0	"	"
Network router	\$20K	0	1	0	0	0

Since there are many remedial measures, some of which apply to multiple systems (a UPS for example), but most of which apply to individual systems, the systems by risks, or “damage done” matrix, **D**, and risks by remedies matrix, **F**, will be quite large. In this simple case, no effort is made to separate risks from remedies, and the analysis is checklist-driven. When the analysis is checklist-driven, each item not passed represents its own risk, and correction is its remedy. In this case, the risks by remedies matrix, **F**, is the identity matrix, and  $D \times F = D$ . This matrix, **D**, is shown following, compiled from Appendixes A through F:

This matrix,  $(D \times F)$ , must be multiplied on the left by the assets matrix shown before, **O**, to see the value at risk mitigation matrix, **V**, described in the first part. The Value-at-Risk Mitigation is also shown on the next page. The sum row at the bottom (on the right) is a rough measure of the value at risk mitigated by each corrective measure, in thousands of dollars annually.





As can be seen above, Email records, Passwords, and Web site assets face the most risk in dollar-value terms that can be mitigated, while the premises protection, UPS, compromise recovery, and Windows 98 system logging remedies appear to be of the largest value in protecting IT assets. The setuid/setgid issues and pagefile clearing appear to be probably worthwhile, while the other measures are less valuable.

The large value mitigated by the UPS may be partly due to double counting independent benefits accruing to both systems #1 and #2. Even if this were adjusted for by dividing by two, it would still be one of the more beneficial corrective measures in gross terms.

The sum-row at the bottom is a rough indication of the dollar value of risk (in thousands of dollars) that any given measure will tend to mitigate during the course of a year. When the assumption that risks and remedies are independent of each other is relaxed it should be understood that some corrective measures will duplicate each other's efforts, and value at risk avoided will be less than the sum of the columns. (In plain language, the columns can tend to double-count the risk reductions, especially when the assets would be saved from total or near total losses from different risks).

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