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GCFA Practical Assignment v1.0



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Assignment 1 - Perform an Analysis on a System

“Automated Hacking”

Synopsis of Case Facts

On May 22, 2002 the ACME customer support center was sent an email from an outside party whom detected multiple scans to their firewall on port 1433(TCP). Below is an excerpt from the email.

-----Original Message-----

From: security@ABCD.com [mailto:security@ABCD.com]

Sent: May 22, 2002 16:44 AM

To: support@ACMECorp.com

Subject: Alert → ACME Corp System (x.x.x.x Routable address)

Our firewall logs have detected scans on port 1433 from your system at x.x.x.x, which may indicate that your system has been infected by the Microsoft SQL Spida Worm.

7 scans on TCP port 1433 were logged at 1:58am EDT May 22, 2002 with a source address of x.x.x.x. Please investigate your system and cease all scanning to our firewall.

Security Administrator,

ABCD.com

security@abcd.com

The system in question was not in operational status, and the service it was configured to provide was unofficially decommissioned. However the system was connected and accessible to the Internet without access control devices such as router access lists or firewalls. It is not believed a software firewall was in place on the system.

After receiving the email, which identified the system may be scanning other systems, ACME Corp made the decision to remove the network cables from the connecting switch and leave the system running for possible investigation at a future date. ACME Corp did not perform any type of investigation on the system until this point. The cord was unplugged from the system by a system administrator on June 4, 2002@23:52:53. The system was then moved to a storage rack, accessible by multiple individuals. On Oct 1, 2002 the system was removed from storage for analysis.

Describe the System you will be Analyzing

The system under analysis is a Windows NT 4.0 server running on a Dell Power Edge 2450. Configuration included hardware RAID 10 with 2 physical drives, effectively equating to RAID 1 (Disk Mirroring). Network configuration is believed to be set to auto-negotiation and part of a /24 routable network.

Reports taken Sept 28, 2002 @ 11:05am from ACME Corp project managers, stated the database server and web server were configured as a functional unit to provide a Web Server based application for a client of ACME Corp. It is believed both systems were of identical configuration with regards to hardware, operating system, account and password configuration. The first system was configured as the IIS Web Server and the second system (under analysis) was configured as a MSSQL 7 database. The Web Server was removed from production and re-deployed before this analysis. Both systems were connected to the Internet via routable address space and were not located behind a firewall or any other protective security measure. The database systems current status is unknown.

The original administrators who installed the system had since left the corporation and few technical details could be gathered. The administrator and any user ID's or passwords were not known, requiring the SAM database to be cracked or modified for online analysis.

Image 1.0 contains the network architecture diagram as provided by the project managers. This diagram was a conceptual model used for the initial design phase. It is believed this is the final architectural model but no other detail is available.

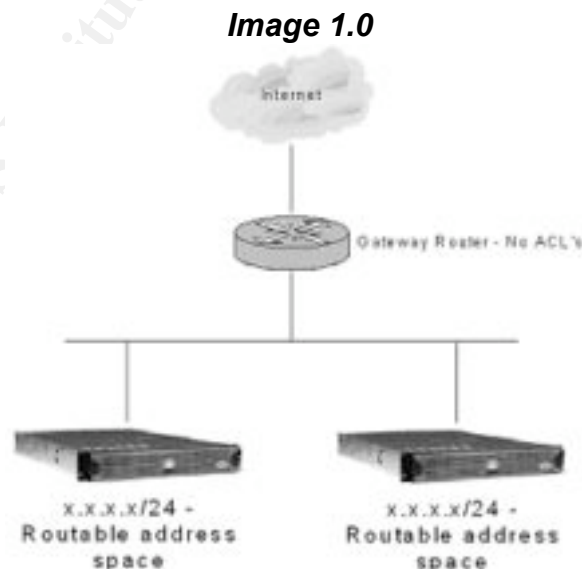


Image the Media

In order to begin a forensics investigation, a method to make exact duplications of the suspect media should be thought out and planned prior to the incident. In some cases this is difficult since the number of unique system configurations, devices and media can vary greatly. In this case, the method to obtain images of the source media was utilizing the Unix utility dd (Data Dump).

I started off by installing Red Hat Linux 7.3 on a separate hard disk and booting into the Linux partition to perform MD5 checksums on the source media. This step was performed to obtain a digital fingerprint of the media in its current state. Once the fingerprint of the original media is obtained, it can be used to verify and ensure the evidence has not changed from the initial investigation and prove the investigator was analyzing an exact duplicate of the source media.

After installing Linux, the boot process on the Dell's revealed that hardware mirroring was in place for the two disks located in slots 0 and 1. In order to prevent any media changes mirroring would have to be disabled, however with no documentation available for the Dell Power Edge 2450 I was not confident I would be able to effectively remove the mirror and guarantee the image integrity. The quickest and easiest way to remove this obstacle was to place the source image on slot 2, which was not part of the mirror configuration. This would make the disk available for duplication while removing the risk of unwanted modification to the media.

Imaging the media is the first technical step in the forensics process and maintaining the integrity of the source media. Any modification to the source media can severely hamper and potentially ruin the forensics investigation.

In order to obtain MD5 checksums it was necessary to specify the partition name, which can be seen with the Unix fdisk command, however to be safe I decided not to run the fdisk command first just in case any accidental changes were made to the media. Instead, another hard disk was placed into the system to identify what device name the system chose when a secondary disk was placed into the slot 2 of the Dell Power Edge 2450 -- This allowed me to run the checksums by intuitively guessing at the partition names.

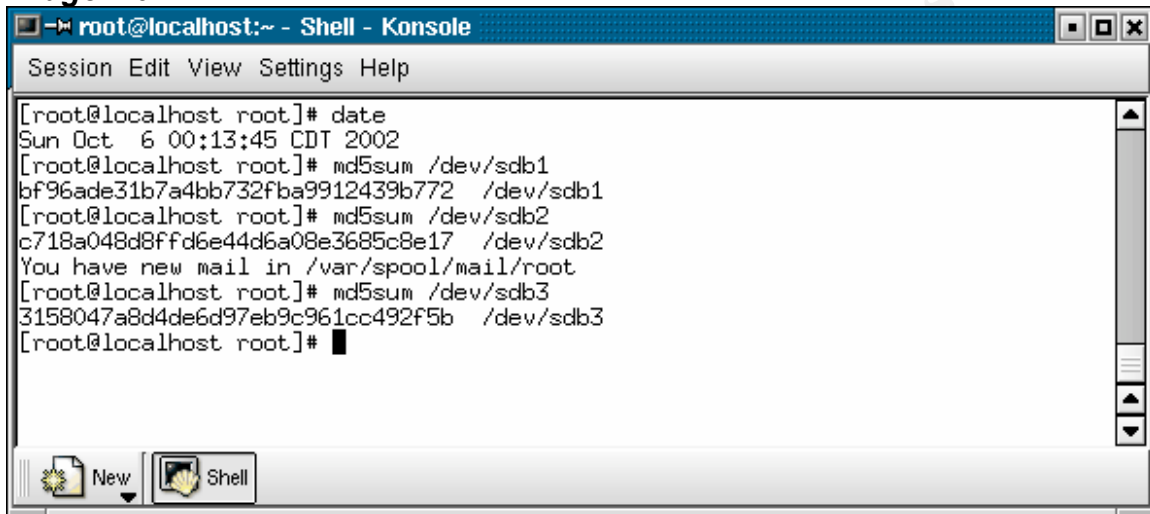
Once the MD5 checksums were obtained from the partitions on the source media relevant to the investigation (/dev/sda2 and /dev/sda3), fdisk was run to display and confirm the partition configurations. (See Images 2.0,2.1) The Unix dd command was then used to make images of the partitions.

The next step was to prepare for the analysis of the images. Although this step could be performed on the original hardware, the images were too large to be kept on the Linux partition for analysis unless zipped. Instead, I used my incident response laptop configured with an externally attached ION USB 2, 120GB hard

disk. The USB 2.0 ION drive was connected to the Linux system installed on the victim hardware and both zipped dd images were copied to the ION drive for analysis. Once each of the images were copied over and unzipped, MD5 checksums were again run to verify the integrity of the images. (See Image 2.2) Additionally, backups of these images were created for safekeeping and zipped.

Note: The partition sdb1 was a Dell utility and not used in this analysis.

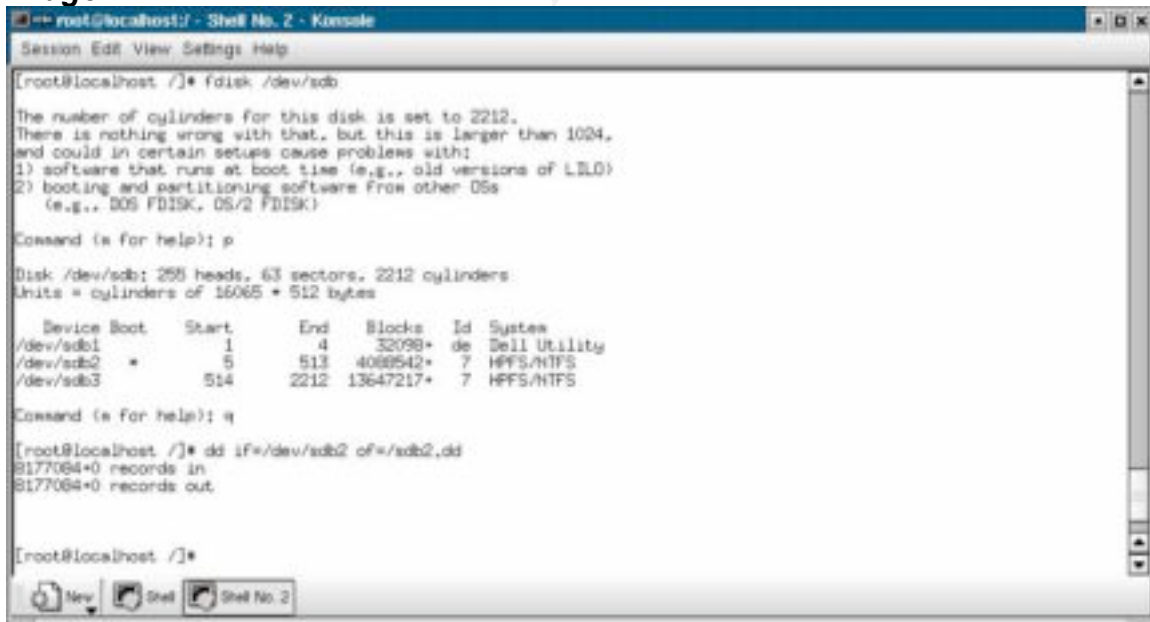
Image 2.0



```
root@localhost:~ - Shell - Konsole
Session Edit View Settings Help

[root@localhost root]# date
Sun Oct  6 00:13:45 CDT 2002
[root@localhost root]# md5sum /dev/sdb1
bf96ade31b7a4bb732fba9912439b772 /dev/sdb1
[root@localhost root]# md5sum /dev/sdb2
c718a048d8fffd6e44d6a08e3685c8e17 /dev/sdb2
You have new mail in /var/spool/mail/root
[root@localhost root]# md5sum /dev/sdb3
3158047a8d4de6d97eb9c961cc492f5b /dev/sdb3
[root@localhost root]#
```

Image 2.1



```
root@localhost: / - Shell No. 2 - Konsole
Session Edit View Settings Help

[root@localhost /]# fdisk /dev/sdb

The number of cylinders for this disk is set to 2212.
There is nothing wrong with that, but this is larger than 1024,
and could in certain setups cause problems with:
 1) software that runs at boot time (e.g., old versions of LILO)
 2) booting and partitioning software from other OSs
    (e.g., DOS fdisk, OS/2 fdisk)

Command (a for help): p

Disk /dev/sdb: 255 heads, 63 sectors, 2212 cylinders
Units = cylinders of 16065 = 512 bytes

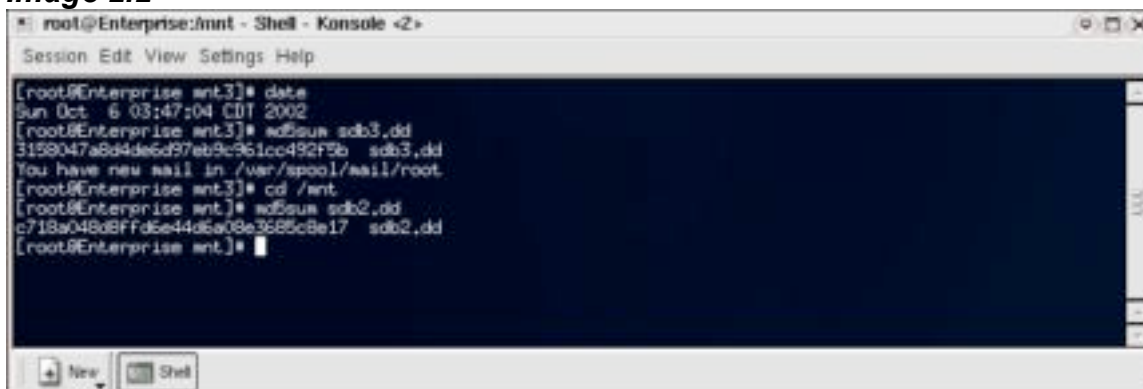
   Device Boot      Start         End      Blocks    Id System
/dev/sdb1            1           4       32096+    de  Dell Utility
/dev/sdb2            5          513     4088542+    7  HPFS/NTFS
/dev/sdb3           514         2212    13647217+    7  HPFS/NTFS

Command (a for help): q

[root@localhost /]# dd if=/dev/sdb2 of=/sdb2.dd
8177064+0 records in
8177064+0 records out

[root@localhost /]#
```

Image 2.2



```
root@Enterprise:~ - Shell - Konsole <2>
Session Edit View Settings Help

[root@Enterprise ~]# date
Sun Oct 6 03:47:04 CDT 2002
[root@Enterprise ~]# strings sdb3.dd
3159047a8d4de6d97eb9c961cc492f5b sdb3.dd
You have new mail in /var/spool/mail/root.
[root@Enterprise ~]# cd /mnt
[root@Enterprise ~]# strings sdb2.dd
c718a048d8ffdc5e44d6a08a3685c8e17 sdb2.dd
[root@Enterprise ~]#
```

String Search

String searches were performed on the two partitions in search of key words such as commonly used hacker speak (jargon) or applications. In this case we also have some pre-analysis investigation information that can be used in the string search, relating to the SQL Worm. Fortunately, technical analysis of the SQL Snake is available at <http://www.incidents.org/diary/diary.php?id=157>ⁱ and provided strings that were used to look for the worms existence. By searching the images sdb2.dd and sdb3.dd using the Unix strings command, evidence that the Worm has infected the ACME Corp system was present. See images 3.0-3.2

Within the technical analysis of the SQL Snake at www.incidents.org are specific strings that were used to identify whether the system was infected and to what extent. The first question that came to mind after reviewing the technical analysis was whether or not the worm on ACME Corp's system behaved the same way as described in the technical analysis at Incidents.org and whether the worm was successful in completing all of the steps as described in the analysis.

Shown in images 3.0-3.2 are excerpts from string search matches on the image sdb2.dd, which was the C drive on the database server. No string matches relating to the SQL Snake were identified within sdb3.dd, the D: drive on the database server.

Additional string searches were performed on both images using common “Hacker Jargon”. No string matches were made on either of the imaged partitions.

String searches were performed on pagefile.sys after being restored for the image sdb2.dd (C: Drive) and no suspicious output was discovered.

Below is an example of the string search used to locate interesting text with the database servers C: drive.

```
# strings -a sdb2.dd | fgrep -f strings.txt >jargon.out
```

Media Analysis

Media analysis for this investigation was accomplished with a, two-step process utilizing offline and online analysis to obtain a comprehensive analysis of the ACME Corp system. The two forms of analysis are as follows:

1. Offline Analysis using Linux – Media **Read Only**
2. Online Analysis with a copy of the Source Media

Because of the circumstances in which this system was left after the initial incident, it is necessary to perform the forensic analysis in the order listed above to obtain the maximum amount of information and exact the minimum amount of changes during the forensics process. After the incident discovery, the system was unplugged from the network and left powered on for a number of months. Although this is an appropriate action, the length of time between the incident and investigation may have resulted in the loss of some valuable information such as system log files that have rolled over in this time frame.

Offline Analysis – Linux Forensics Tools

The first step of this process uses the Linux offline analysis in which the previously created dd images will be analyzed with Linux forensics tools. Part of this analysis requires the data dump image to be mounted read only from Linux. While Linux is capable of reading Windows NTFS partitions, the source kernel must be modified and re-compiled to enable this feature. To do this, I followed a procedure outlined on <http://www.getlinuxonline.com>.ⁱⁱ Enabling this option allows Linux to read NTFS partitions in read only mode, which is very important for this analysis since it guarantees the data dump file will not be modified in any way.

To mount the images, the command mount is used with the following options:

```
# mount -o ro noatime, noexec, nosuid, nouser, loop -t ntfs /dev/sdb2.dd /mnt
```

- -o ro (Specifies the partition will be mounted read only)

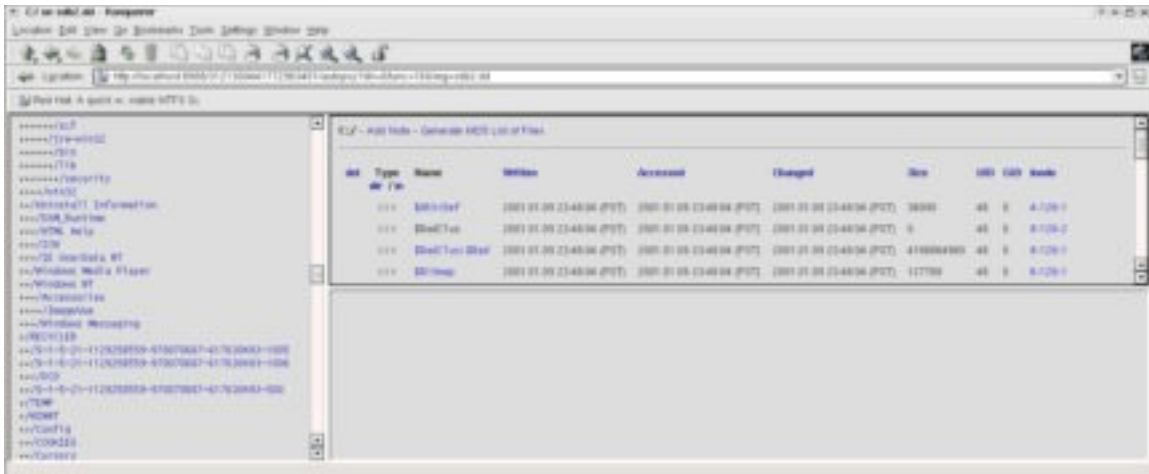
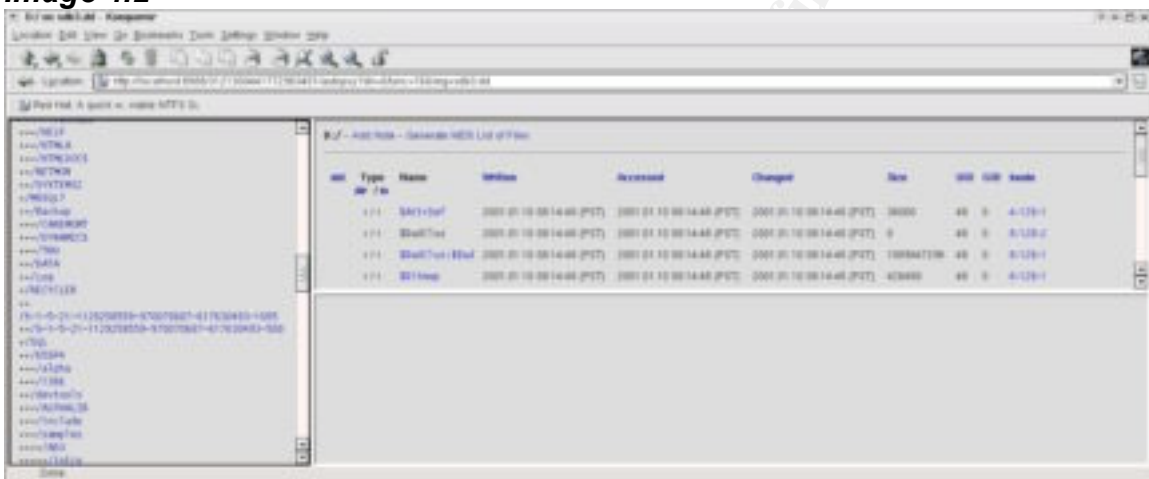


Image 4.2



The system was searched for .pst mail files by both keyword search and manual file location via Autopsy. No pst files were present on the system.

Live Online Analysis – Windows Forensics Tools

The ACME Corporation’s database server was powered down on initial investigation so an offline analysis was chosen as the first action since it is the easiest and safest form of analysis. However, an exact duplicate of the original media was created and since the hardware was available, I found it worthwhile to boot a copy of the original media for further analysis. This allowed me to extract data that could not be easily found in an offline analysis, such as the live system behavior, a dump of system memory, network information and more.

Since Windows systems automatically mounts and write to all attached windows partitions and no hardware write block was available on the hard disk, the order of commands run during the online analysis was important. One of the key principals of forensics is to maintain the integrity of the victim system and minimize changes. Although it is extremely difficult to prevent any changes from occurring on a live system, steps can be taken to minimize these effects. Each

command was run and monitored with filemon.exe – www.sysinternals.com to verify the effects it would have on the victim systems MAC times and any file changes.

Another important step to ensure everything went as planned was to create a forensics CD to run commands from. This step would ensure the commands were executed as planned, avoiding any typing mistakes or miscalculations. Once the CD-R was created, an MD5 checksum was made for each program on the CD. Important to note is that each system may require a different forensic process dependant on hardware, software, environmental circumstances, access and many other variables. Below is the process that was developed for the online analysis of the ACME Corp system.

Preparation and Analysis Process

1. Extract and crack victim systems SAM database – Password was not known by ACME Corp.
 - a. Autopsy was used to extract the SAM database, pwdump2 to grab the hashes and john-the-ripper was used to crack the passwords. See Image 5.0-5.1

Image 5.0

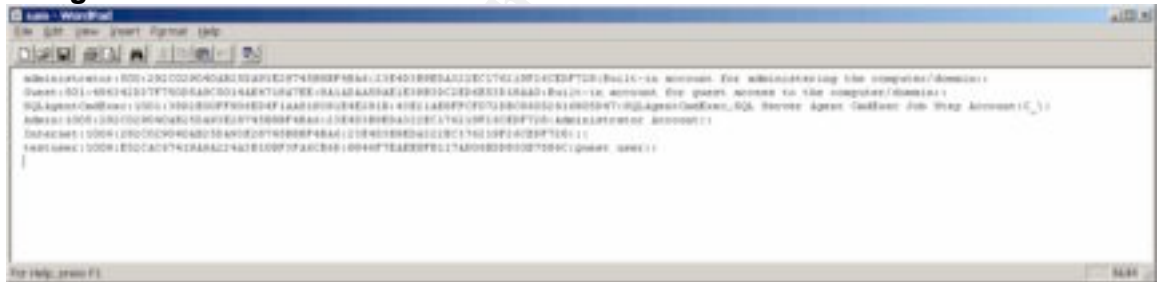
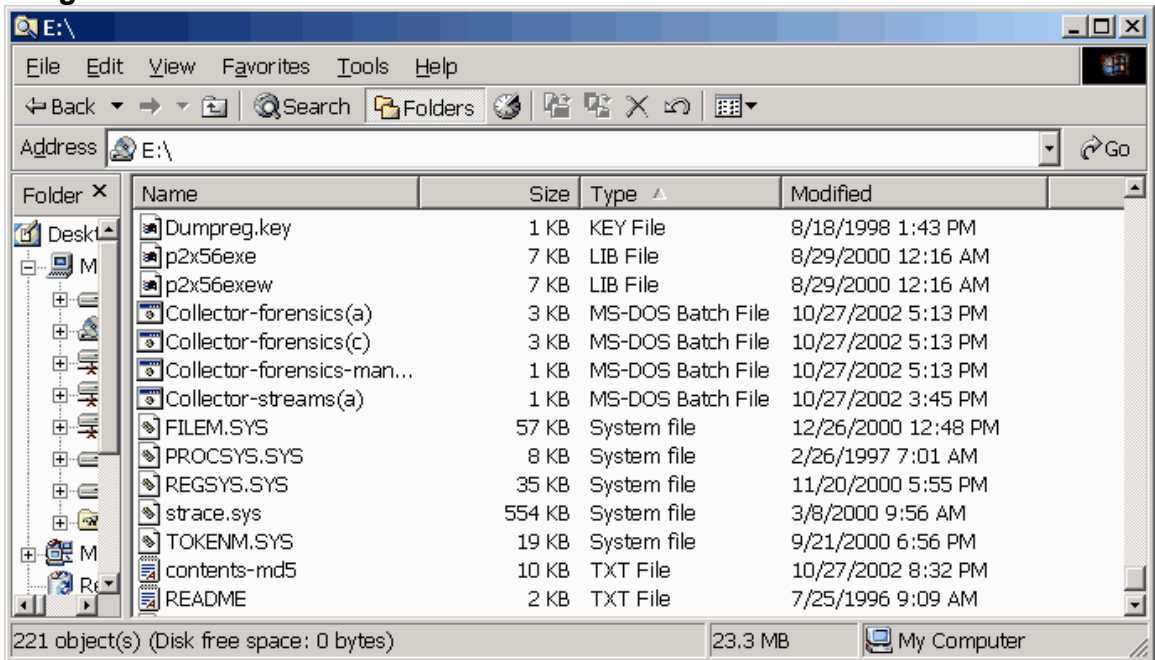


Image 5.1



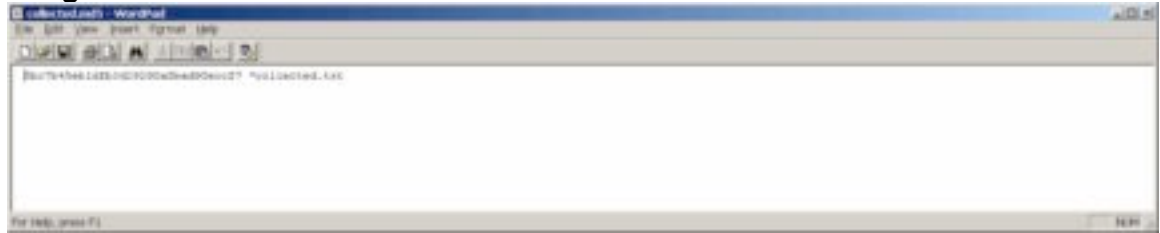
2. Create forensics CD-R with all applicable tools required to investigate the ACME Corp system. See Image 6.0

Image 6.0



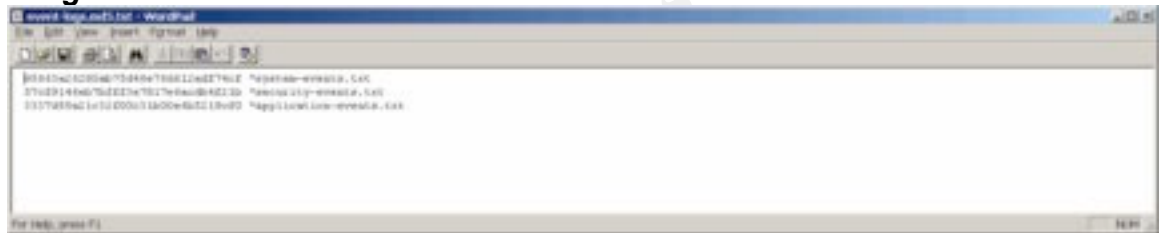
3. Create MD5SUM of CD-R forensics tools. (Seen in screenshot – contents.md5)
4. Create a batch file to automatically run all of the forensics tools needed for analysis. (Seen in screenshot above (collector-forensics(a).bat)ⁱⁱⁱ)
5. Configure Monitoring system to capture all packets originating from the victim system.
 - a. Connect to 10BaseT hub
 - b. tcpdump -i eth0
6. Configure forensics workstation with netcat to receive command output.
 - a. Forensics Station → nc -l -p 1010
 - b. Victim System → command | nc 192.168.0.1 1010
7. Connect victim system, monitoring system and forensic workstation to and ethernet hub, allowing all packets to be seen by the monitoring system.
8. Boot victim system with image of original media.
9. Login to the system using the cracked SAM database password.
10. Insert forensics CD-R and double click on the cmd.exe located on the CD-R.
11. Manually capture memory contents with dd.
 - a. dd.exe if=\\.\PhysicalMemory conv=noerror | nc 192.168.0.1 1010
 - b. Note: This capture failed due to the following error: The procedure entry point VerSetConditionMask could not be located in the dynamic link library – Kernel32.dll. An attempt was made to use memdump.exe as a backup but it also failed.
12. Run the forensics batch file, which executes all of the required commands and saves the output to the A: drive with an md5 checksum of the collected.txt file.
 - a. E:\forensics-collector.bat See Image 7.0

Image 7.0



13. Run dumpel to extract Windows event logs. See Image 8.0
 - a. `dumpel -l system -t | nc 192.168.0.1 1010 (Forensics Workstation)`
`> system-events.txt`
 - b. `dumpel -l security -t | nc 192.168.0.1 1010 (Forensics Workstation)`
`> security-events.txt`
 - c. `dumpel -l application -t | nc 192.168.0.1 1010 (Forensics Workstation)`
`> application-events.txt`

Image 8.0



14. Run dumpreg manually (GUI-Tool) to dump all registry entries for analysis. Transferred to forensics workstation via netcat.
 - a. HKEY_LOCAL_MACHINE
 - b. HKEY_USERS
 - c. HKEY_CURRENT_USER
 - d. Files were saved to a secondary blank hdd (d:) that was mounted as a temp storage disk if required. Files were then transferred to the forensics workstation via netcat.
15. Booted Windows 2000 disk on victim system and ran streams to identify any alternate data streams files:
 - a. None ADS files were located.

Commands used for gathering data and analysis, in order of execution.

Command	Media Access C:	Media Write C:	File Write
<code>time /t</code>	no	No	
<code>date /t</code>	no	No	
<code>netstat -an</code>	yes	No	
<code>fport</code>	yes	No	
<code>nbtstat -c</code>	yes	Yes	C:\WINNT\System32\Config\sysevent.evt
<code>arp -a</code>	yes	No	
<code>route print</code>	yes	No	
<code>pslist</code>	yes	No	
<code>ps -eaW</code>	yes	No	
<code>net accounts</code>	yes	No	

net file	yes	No	
net session	yes	No	
net share	yes	No	
net start	yes	No	
net use	yes	No	
net view	yes	No	
uname -a	yes	No	
uptime	yes	No	
hostname	yes	No	
whoami	yes	no	
psinfo	no	no	
env	yes	no	
psloggedon	yes	no	
ntlast	yes	no	
listdlls	yes	no	
at	yes	no	
sniffer	yes	yes	C:\Documents and Settings\user\Local Settings\TEMP\lanman.dll
mdmchk	yes	yes	C:\Documents and Settings\user\Local Settings\TEMP\registry.dll
share -s localhost -f	yes	yes	C:\Documents and Settings\user\Local Settings\TEMP\lanman.dll
			C:\Documents and Settings\user\Local Settings\TEMP\Perms.dll
			C:\Documents and Settings\user\Local Settings\TEMP\AdminMisc.dll
ntfsinfo c:	yes	yes	C:\Documents and Settings\user\Local Settings\TEMP\~DF383F.tmp
			C:\$MFT
			C:\$logfile
rasautou -s	yes	no	

Live system analysis will always include a certain level of compromise when it comes to system changes. While care was taken in command selection and execution, some commands need to write to the source media. Noting which commands made changes to the victim file system and what changes were made will ensure these changes are not included in the analysis. In this forensic analysis, the source media has been duplicated offline, thus modifications to this media do not compromise the originality of the victim system.

Results from ACME Corp System:

```
COMMAND RUN:date /t
Sun 10/27/2002
COMMAND RUN:time /t
9:28p
COMMAND RUN:netstat -an
```

Active Connections

Proto	Local Address	Foreign Address	State
TCP	0.0.0.0:135	0.0.0.0:0	LISTENING
TCP	0.0.0.0:135	0.0.0.0:0	LISTENING
TCP	0.0.0.0:1527	0.0.0.0:0	LISTENING
TCP	0.0.0.0:1529	0.0.0.0:0	LISTENING
TCP	0.0.0.0:1630	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3067	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3068	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3069	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3070	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3071	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3072	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3073	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3074	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3075	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3076	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3077	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3078	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3079	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3080	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3081	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3082	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3083	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3084	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3085	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3086	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3087	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3088	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3089	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3090	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3091	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3092	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3093	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3094	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3095	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3096	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3097	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3098	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3099	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3100	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3101	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3102	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3103	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3104	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3105	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3106	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3107	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3108	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3109	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3110	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3111	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3112	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3113	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3114	0.0.0.0:0	LISTENING

TCP	0.0.0.0:3115	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3116	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3117	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3118	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3119	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3120	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3121	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3122	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3123	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3124	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3125	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3126	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3127	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3128	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3129	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3130	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3131	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3132	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3133	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3134	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3135	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3136	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3137	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3138	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3139	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3140	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3141	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3142	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3143	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3144	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3145	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3146	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3147	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3148	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3149	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3150	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3151	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3152	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3153	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3154	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3155	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3156	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3157	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3158	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3159	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3160	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3161	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3162	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3163	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3164	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3165	0.0.0.0:0	LISTENING
TCP	0.0.0.0:3166	0.0.0.0:0	LISTENING
TCP	10.0.0.1:137	0.0.0.0:0	LISTENING
TCP	10.0.0.1:138	0.0.0.0:0	LISTENING
TCP	10.0.0.1:139	0.0.0.0:0	LISTENING
TCP	127.0.0.1:1525	0.0.0.0:0	LISTENING

TCP	127.0.0.1:1525	127.0.0.1:1630	ESTABLISHED
TCP	127.0.0.1:1526	0.0.0.0	LISTENING
TCP	127.0.0.1:1528	0.0.0.0	LISTENING
TCP	127.0.0.1:1630	127.0.0.1:1525	ESTABLISHED
TCP	192.168.50.50:137	0.0.0.0	LISTENING
TCP	192.168.50.50:138	0.0.0.0	LISTENING
TCP	192.168.50.50:139	0.0.0.0	LISTENING
TCP	192.168.50.50:139	192.168.50.50:1766	ESTABLISHED
TCP	192.168.50.50:1564	192.168.50.50:139	TIME_WAIT
TCP	192.168.50.50:1766	0.0.0.0	LISTENING
TCP	192.168.50.50:1766	192.168.50.50:139	ESTABLISHED
TCP	192.168.50.50:3067	10.0.0.31:1433	SYN_SENT
TCP	192.168.50.50:3068	10.0.0.32:1433	SYN_SENT
TCP	192.168.50.50:3069	10.0.0.33:1433	SYN_SENT
TCP	192.168.50.50:3070	10.0.0.34:1433	SYN_SENT
TCP	192.168.50.50:3071	10.0.0.35:1433	SYN_SENT
TCP	192.168.50.50:3072	10.0.0.36:1433	SYN_SENT
TCP	192.168.50.50:3073	10.0.0.37:1433	SYN_SENT
TCP	192.168.50.50:3074	10.0.0.38:1433	SYN_SENT
TCP	192.168.50.50:3075	10.0.0.39:1433	SYN_SENT
TCP	192.168.50.50:3076	10.0.0.40:1433	SYN_SENT
TCP	192.168.50.50:3077	10.0.0.41:1433	SYN_SENT
TCP	192.168.50.50:3078	10.0.0.42:1433	SYN_SENT
TCP	192.168.50.50:3079	10.0.0.43:1433	SYN_SENT
TCP	192.168.50.50:3080	10.0.0.44:1433	SYN_SENT
TCP	192.168.50.50:3081	10.0.0.45:1433	SYN_SENT
TCP	192.168.50.50:3082	10.0.0.46:1433	SYN_SENT
TCP	192.168.50.50:3083	10.0.0.47:1433	SYN_SENT
TCP	192.168.50.50:3084	10.0.0.48:1433	SYN_SENT
TCP	192.168.50.50:3085	10.0.0.49:1433	SYN_SENT
TCP	192.168.50.50:3086	10.0.0.50:1433	SYN_SENT
TCP	192.168.50.50:3087	10.0.0.51:1433	SYN_SENT
TCP	192.168.50.50:3088	10.0.0.52:1433	SYN_SENT
TCP	192.168.50.50:3089	10.0.0.53:1433	SYN_SENT
TCP	192.168.50.50:3090	10.0.0.54:1433	SYN_SENT
TCP	192.168.50.50:3091	10.0.0.55:1433	SYN_SENT
TCP	192.168.50.50:3092	10.0.0.56:1433	SYN_SENT
TCP	192.168.50.50:3093	10.0.0.57:1433	SYN_SENT
TCP	192.168.50.50:3094	10.0.0.58:1433	SYN_SENT
TCP	192.168.50.50:3095	10.0.0.59:1433	SYN_SENT
TCP	192.168.50.50:3096	10.0.0.60:1433	SYN_SENT
TCP	192.168.50.50:3097	10.0.0.61:1433	SYN_SENT
TCP	192.168.50.50:3098	10.0.0.62:1433	SYN_SENT
TCP	192.168.50.50:3099	10.0.0.63:1433	SYN_SENT
TCP	192.168.50.50:3100	10.0.0.64:1433	SYN_SENT
TCP	192.168.50.50:3101	10.0.0.65:1433	SYN_SENT
TCP	192.168.50.50:3102	10.0.0.66:1433	SYN_SENT
TCP	192.168.50.50:3103	10.0.0.67:1433	SYN_SENT
TCP	192.168.50.50:3104	10.0.0.68:1433	SYN_SENT
TCP	192.168.50.50:3105	10.0.0.69:1433	SYN_SENT
TCP	192.168.50.50:3106	10.0.0.70:1433	SYN_SENT
TCP	192.168.50.50:3107	10.0.0.71:1433	SYN_SENT
TCP	192.168.50.50:3108	10.0.0.72:1433	SYN_SENT
TCP	192.168.50.50:3109	10.0.0.73:1433	SYN_SENT
TCP	192.168.50.50:3110	10.0.0.74:1433	SYN_SENT
TCP	192.168.50.50:3111	10.0.0.75:1433	SYN_SENT

TCP	192.168.50.50:3112	10.0.0.76:1433	SYN_SENT
TCP	192.168.50.50:3113	10.0.0.77:1433	SYN_SENT
TCP	192.168.50.50:3114	10.0.0.78:1433	SYN_SENT
TCP	192.168.50.50:3115	10.0.0.79:1433	SYN_SENT
TCP	192.168.50.50:3116	10.0.0.80:1433	SYN_SENT
TCP	192.168.50.50:3117	10.0.0.81:1433	SYN_SENT
TCP	192.168.50.50:3118	10.0.0.82:1433	SYN_SENT
TCP	192.168.50.50:3119	10.0.0.83:1433	SYN_SENT
TCP	192.168.50.50:3120	10.0.0.84:1433	SYN_SENT
TCP	192.168.50.50:3121	10.0.0.85:1433	SYN_SENT
TCP	192.168.50.50:3122	10.0.0.86:1433	SYN_SENT
TCP	192.168.50.50:3123	10.0.0.87:1433	SYN_SENT
TCP	192.168.50.50:3124	10.0.0.88:1433	SYN_SENT
TCP	192.168.50.50:3125	10.0.0.89:1433	SYN_SENT
TCP	192.168.50.50:3126	10.0.0.90:1433	SYN_SENT
TCP	192.168.50.50:3127	10.0.0.91:1433	SYN_SENT
TCP	192.168.50.50:3128	10.0.0.92:1433	SYN_SENT
TCP	192.168.50.50:3129	10.0.0.93:1433	SYN_SENT
TCP	192.168.50.50:3130	10.0.0.94:1433	SYN_SENT
TCP	192.168.50.50:3131	10.0.0.95:1433	SYN_SENT
TCP	192.168.50.50:3132	10.0.0.96:1433	SYN_SENT
TCP	192.168.50.50:3133	10.0.0.97:1433	SYN_SENT
TCP	192.168.50.50:3134	10.0.0.98:1433	SYN_SENT
TCP	192.168.50.50:3135	10.0.0.99:1433	SYN_SENT
TCP	192.168.50.50:3136	10.0.0.100:1433	SYN_SENT
TCP	192.168.50.50:3137	10.0.0.101:1433	SYN_SENT
TCP	192.168.50.50:3138	10.0.0.102:1433	SYN_SENT
TCP	192.168.50.50:3139	10.0.0.103:1433	SYN_SENT
TCP	192.168.50.50:3140	10.0.0.104:1433	SYN_SENT
TCP	192.168.50.50:3141	10.0.0.105:1433	SYN_SENT
TCP	192.168.50.50:3142	10.0.0.106:1433	SYN_SENT
TCP	192.168.50.50:3143	10.0.0.107:1433	SYN_SENT
TCP	192.168.50.50:3144	10.0.0.108:1433	SYN_SENT
TCP	192.168.50.50:3145	10.0.0.109:1433	SYN_SENT
TCP	192.168.50.50:3146	10.0.0.110:1433	SYN_SENT
TCP	192.168.50.50:3147	10.0.0.111:1433	SYN_SENT
TCP	192.168.50.50:3148	10.0.0.112:1433	SYN_SENT
TCP	192.168.50.50:3149	10.0.0.113:1433	SYN_SENT
TCP	192.168.50.50:3150	10.0.0.114:1433	SYN_SENT
TCP	192.168.50.50:3151	10.0.0.115:1433	SYN_SENT
TCP	192.168.50.50:3152	10.0.0.116:1433	SYN_SENT
TCP	192.168.50.50:3153	10.0.0.117:1433	SYN_SENT
TCP	192.168.50.50:3154	10.0.0.118:1433	SYN_SENT
TCP	192.168.50.50:3155	10.0.0.119:1433	SYN_SENT
TCP	192.168.50.50:3156	10.0.0.120:1433	SYN_SENT
TCP	192.168.50.50:3157	10.0.0.121:1433	SYN_SENT
TCP	192.168.50.50:3158	10.0.0.122:1433	SYN_SENT
TCP	192.168.50.50:3159	10.0.0.123:1433	SYN_SENT
TCP	192.168.50.50:3160	10.0.0.124:1433	SYN_SENT
TCP	192.168.50.50:3161	10.0.0.125:1433	SYN_SENT
TCP	192.168.50.50:3162	10.0.0.126:1433	SYN_SENT
TCP	192.168.50.50:3163	10.0.0.127:1433	SYN_SENT
TCP	192.168.50.50:3164	10.0.0.128:1433	SYN_SENT
TCP	192.168.50.50:3165	10.0.0.129:1433	SYN_SENT
TCP	192.168.50.50:3166	10.0.0.130:1433	SYN_SENT
UDP	0.0.0.0:135	***	

```
UDP 10.0.0.1:137    *.*
UDP 10.0.0.1:138    *.*
UDP 192.168.50.50:137 *.*
UDP 192.168.50.50:138 *.*
```

```
COMMAND RUN:fport
FPort v2.0 - TCP/IP Process to Port Mapper
Copyright 2000 by Foundstone, Inc.
http://www.foundstone.com
```

```
COMMAND RUN:nbtstat -c
COMMAND RUN:arp -a
No ARP Entries Found
COMMAND RUN:route print
```

```
=====
==
```

Interface List

```
0x1 ..... MS TCP Loopback interface
0x2 ...00 02 b3 1e 56 42 ..... Intel(R) PRO PCI Adapter
0x3 ...00 02 b3 1e 56 e1 ..... Intel(R) PRO PCI Adapter
```

```
=====
==
```

```
=====
==
```

Active Routes:

Network	Destination	Netmask	Gateway	Interface	Metric
0.0.0.0	0.0.0.0	255.0.0.0	192.168.50.145	192.168.50.50	1
10.0.0.0	255.255.255.0		10.0.0.1	10.0.0.1	1
10.0.0.1	255.255.255.255		127.0.0.1	127.0.0.1	1
10.255.255.255	255.255.255.255		10.0.0.1	10.0.0.1	1
127.0.0.0	255.0.0.0		127.0.0.1	127.0.0.1	1
192.168.50.144	255.255.255.240		192.168.50.50	192.168.50.50	1
192.168.50.50	255.255.255.255		127.0.0.1	127.0.0.1	1
192.168.50.255	255.255.255.255		192.168.50.50	192.168.50.50	1
224.0.0.0	224.0.0.0		10.0.0.1	10.0.0.1	1
224.0.0.0	224.0.0.0		192.168.50.50	192.168.50.50	1
255.255.255.255	255.255.255.255		10.0.0.1	10.0.0.1	1

```
=====
==
```

```
COMMAND RUN:pslist
```

```
PsList v1.12 - Process Information Lister
Copyright (C) 1999-2000 Mark Russinovich
Systems Internals - http://www.sysinternals.com
```

```
Process information for ACME-CORP:
```

Name	Pid	Pri	Thd	Hnd	Mem	User Time	Kernel Time	Elapsed Time
Idle	0	0	1	0	16	0:00:00.000	0:10:29.531	0:11:05.875
System	2	8	35	639	216	0:00:00.000	0:00:24.484	0:11:05.875
SMSS	28	11	6	30	396	0:00:00.062	0:00:00.046	0:11:05.875
CSRSS	40	13	9	346	1752	0:00:00.031	0:00:00.500	0:10:58.671
WINLOGON	46	13	2	39	312	0:00:00.125	0:00:00.500	0:10:56.687
SERVICES	48	9	19	241	4088	0:00:00.156	0:00:00.562	0:10:55.796
LSASS	51	9	12	109	2932	0:00:00.062	0:00:00.078	0:10:54.750
SPOOLSS	77	8	6	55	1936	0:00:00.015	0:00:00.000	0:10:43.140

```

NETDDE      82  8  4  26 1156 0:00:00.015 0:00:00.015 0:10:43.000
NETDDE      91  8  5  29 1300 0:00:00.015 0:00:00.015 0:10:42.593
wscript    103  8  3  37 3360 0:00:00.046 0:00:00.031 0:10:40.968
RPCSS       194  8  6  82 1096 0:00:00.046 0:00:00.015 0:09:46.062
msdtc      202  8 16  94 3448 0:00:00.031 0:00:00.031 0:09:45.968
sqlservr   258  8 18 249 32764 0:00:01.859 0:00:00.109 0:09:44.578
PSTORES    264  8  4  37  408 0:00:00.062 0:00:00.031 0:09:43.859
LOCATOR     267  8  5  37 1416 0:00:00.015 0:00:00.000 0:09:43.828
sqlagent    87  8  8  77 1836 0:00:00.078 0:00:00.062 0:09:40.218
services   136  8 103 679 2988 0:00:09.781 0:00:00.234 0:02:39.093
NDDEAGNT   315  8  1  16 1052 0:00:00.015 0:00:00.000 0:02:32.281
EXPLORER   221  8  5  52 3272 0:00:00.140 0:00:01.125 0:02:30.765
PROMon     131  8  1  21 1164 0:00:00.015 0:00:00.000 0:02:29.109
LOADWC     225  8  1  17 1064 0:00:00.015 0:00:00.000 0:02:29.109
sqlmangr   216  8  2  34 1864 0:00:00.046 0:00:00.078 0:02:29.093
CMD        209  8  1  22 1260 0:00:00.031 0:00:00.046 0:01:34.656
PSLIST     314  8  1  44 1848 0:00:00.062 0:00:00.078 0:00:00.484

```

COMMAND RUN:ps -ealW

```

PID  PPID  PGID  WINPID  TTY  UID  STIME  COMMAND
  2    0    0     2  ?  0 12:24:48 *** unknown ***
 28    0    0    28  ?  0 21:17:25 \SystemRoot\System32\smss.exe
 46    0    0    46  ?  0 21:17:35 \??\C:\WINNT\system32\winlogon.exe
 48    0    0    48  ?  0 21:17:35 C:\WINNT\system32\services.exe
 51    0    0    51  ?  0 21:17:37 C:\WINNT\system32\lsass.exe
 77    0    0    77  ?  0 21:17:48 C:\WINNT\system32\spoolss.exe
 82    0    0    82  ?  0 21:17:48 C:\WINNT\system32\netdde.exe
 91    0    0    91  ?  0 21:17:49 C:\WINNT\system32\NETDDE.EXE
103    0    0   103  ?  0 21:17:50 C:\WINNT\System32\WScript.exe
194    0    0   194  ?  0 21:18:45 C:\WINNT\system32\RpcSs.exe
202    0    0   202  ?  0 21:18:45 C:\WINNT\System32\msdtc.exe
264    0    0   264  ?  0 21:18:47 c:\winnt\system32\pstores.exe
267    0    0   267  ?  0 21:18:47 C:\WINNT\System32\LOCATOR.EXE
136    0    0   136  ?  0 21:25:52 C:\WINNT\system32\drivers\services.exe
315    0    0   315  ?  0 21:25:59 C:\WINNT\System32\nddeagnt.exe
221    0    0   221  ?  0 21:26:01 C:\WINNT\Explorer.exe
131    0    0   131  ?  0 21:26:02 C:\WINNT\System32\PROMon.exe
225    0    0   225  ?  0 21:26:02 C:\WINNT\System32\loadwc.exe
216    0    0   216  ?  0 21:26:02 C:\MSSQL7\Binn\sqlmangr.exe
209    0    0   209  ?  0 21:26:57 E:\CMD.EXE
175    1   175   175  con 500 21:28:35 /cygdrive/e/ps

```

COMMAND RUN:net accounts

```

Force user logoff how long after time expires?:    Never
Minimum password age (days):                      0
Maximum password age (days):                      42
Minimum password length:                           0
Length of password history maintained:              None
Lockout threshold:                                 Never
Lockout duration (minutes):                         30
Lockout observation window (minutes):               30
Computer role:                                     PRIMARY

```

The command completed successfully.

COMMAND RUN:net file

There are no entries in the list.

COMMAND RUN:net session

```

Computer      User name      Client Type    Opens Idle time

```

Steven G Lukacs

22

GCFA Practical Assignment

\\ACME-CORP qadmin Windows NT 1381 0 00:02:38
The command completed successfully.
COMMAND RUN:net share

Share name	Resource	Remark
ADMIN\$	C:\WINNT	Remote Admin
IPC\$		Remote IPC
C\$	C:\	Default share
D\$	D:\	Default share
DATA	D:\DATA	
NETLOGON	C:\WINNT\system32\Rep\Import\S Logon server share	

The command completed successfully.
COMMAND RUN:net start
These Windows NT services are started:

- Alerter
- Computer Browser
- EventLog
- Messenger
- MSDTC
- MSSQLServer
- Net Logon
- Network DDE DSDM
- NT LM Security Support Provider
- Plug and Play
- Protected Storage
- Remote Procedure Call (RPC) Locator
- Remote Procedure Call (RPC) Service
- Server
- Spooler
- SQLServerAgent
- TCP/IP NetBIOS Helper
- Workstation

The command completed successfully.
COMMAND RUN:net use
New connections will be remembered.

Status	Local	Remote	Network
Disconnected F:		\\ACME-CORP\DATA	Microsoft Windows Network

The command completed successfully.
COMMAND RUN:net view
Server Name Remark

\\ACME-CORP
The command completed successfully.
COMMAND RUN:uptime
\\ACME-CORP has been up for: 0 day(s), 0 hour(s), 11 minute(s), 39 second(s)
COMMAND RUN:uname -a
CYGWIN_NT-4.0 ACME-CORP 1.3.3(0.46/3/2) 2001-09-12 23:54 i686 unknown
COMMAND RUN:hostname
ACME-CORP
COMMAND RUN:whoami
QAdmin

COMMAND RUN:psinfo

PsInfo v1.11 - local and remote system information viewer
Copyright (C) 2001 Mark Russinovich
Sysinternals - www.sysinternals.com

Querying information for ...

System information for \\ACME-CORP:

Kernel version: Microsoft Windows NT, Multiprocessor Free
Product type: Server (Domain Controller)
Product version: 4.0
Service pack: 6
Kernel build number: 1381
Registered organization: ACME Corp
Registered owner: ACME Corp
Install date: 1/10/01, 9:12:57 AM
System root: C:\WINNT
Processors: 1
Processor speed: 730 MHz
Processor type: x86 Family 6 Model 8 Stepping 6, GenuineIntel
Physical memory: 512 MB
HotFixes:
Q147222: No Description
Q246009: Windows NT 4.0 Hotfix: Service Pack 6 Re-release

COMMAND RUN:env

IE:=E:\

!EXITCODE=00000006

ASANY=C:\Program Files\Sybase\Adaptive Server Anywhere 6.0

COMPUTERNAME=ACME-CORP

COMSPEC=C:\WINNT\system32\cmd.exe

HOMEDRIVE=C:

HOMEPAATH=\

LOGONSERVER=\\ACME-CORP

NUMBER_OF_PROCESSORS=1

OS=Windows_NT

OS2LIBPATH=C:\WINNT\system32\os2\dll;

PATH=/cygdrive/c/WINNT/system32:/cygdrive/c/WINNT:/cygdrive/c/MSSQL7/BINN:/cygdrive/c/Program Files/Sybase/Adaptive Server Anywhere 6.0/win32

PATHEXT=.COM;.EXE;.BAT;.CMD;.VBS;.VBE;.JS;.JSE;.WSF;.WSH

PROCESSOR_ARCHITECTURE=x86

PROCESSOR_IDENTIFIER=x86 Family 6 Model 8 Stepping 6, GenuineIntel

PROCESSOR_LEVEL=6

PROCESSOR_REVISION=0806

PROMPT=\$P\$G

SYSTEMDRIVE=C:

SYSTEMROOT=C:\WINNT

TEMP=/cygdrive/c/TEMP

TMP=/cygdrive/c/TEMP

USERDOMAIN=ACME Corp

USERNAME=QAdmin

USERPROFILE=C:\WINNT\Profiles\QAdmin

WINDIR=C:\WINNT

TERM=cygwin

COMMAND RUN:psloggedon

PsLoggedOn v1.21 - Logon Session Displayer
Copyright (C) 1999-2000 Mark Russinovich
SysInternals - www.sysinternals.com

Users logged on locally:

10/27/02 9:25:58 PM ACME Corp\QAdmin
<Unknown> ACME Corp\qadministrator

Users logged on via resource shares:

10/27/02 9:25:58 PM ACME Corp\qadmin
COMMAND RUN:ntlast -r -f
SQLAgentCmdExec ACME-CORP ACME-CORP Sun Oct 27 09:19:01pm 2002
SQLAgentCmdExec ACME-CORP ACME-CORP Sun Oct 27 09:18:58pm 2002
SQLAgentCmdExec ACME-CORP ACME-CORP Tue Jun 04 03:38:58pm 2002
SQLAgentCmdExec ACME-CORP ACME-CORP Tue Jun 04 03:38:55pm 2002
AA \\\AA DD Sat Mar 30 04:37:29pm 2002
AA \\\AA DD Sat Mar 30 04:37:26pm 2002
PRINT SERVER \\\PRINTSERVER INFOMATIC Sat Mar 30 08:24:57am 2002
PRINT SERVER \\\PRINTSERVER INFOMATIC Sat Mar 30 08:24:54am 2002
ADMINISTRATOR \\\PTRHS PCS Thu Mar 14 12:53:05pm 2002
COMMAND RUN:listdlls

ListDLLs V2.23 - DLL lister for Win9x/NT
Copyright (C) 1997-2000 Mark Russinovich
<http://www.sysinternals.com>

System pid: 2

Command line: <no command line>

SMSS.EXE pid: 28

Command line: \SystemRoot\System32\smss.exe

Base	Size	Version	Path
0x023a0000	0xc000		\\SystemRoot\System32\smss.exe
0x77f60000	0x5e000	4.00.1381.0298	C:\WINNT\System32\ntdll.dll

CSRSS.EXE pid: 40

Command line: C:\WINNT\system32\csrss.exe ObjectDirectory=\Windows
SharedSection=1024,3072 Windows=On SubSystemType=Windows ServerDll=basesrv,1
ServerDll=winsrv:UserServerDllInitialization,3 ServerDll=winsrv:ConServerDllInitialization,2
ProfileControl=Off MaxRequestThreads=16

Base	Size	Version	Path
0x4a680000	0x5000		\\??C:\WINNT\system32\csrss.exe
0x77f60000	0x5e000	4.00.1381.0298	C:\WINNT\System32\ntdll.dll
0x5ff90000	0xb000	4.00.1381.0279	C:\WINNT\system32\CSRSRV.dll
0x5ffa0000	0xc000	4.00.1381.0273	C:\WINNT\system32\basesrv.dll
0x5ffb0000	0x30000	4.00.1381.0298	C:\WINNT\system32\winsrv.dll
0x77e70000	0x55000	4.00.1381.0310	C:\WINNT\system32\USER32.dll
0x77f00000	0x5e000	4.00.1381.0300	C:\WINNT\system32\KERNEL32.dll
0x77ed0000	0x2c000	4.00.1381.0298	C:\WINNT\system32\GDI32.dll
0x77dc0000	0x3f000	4.00.1381.0281	C:\WINNT\system32\ADVAPI32.dll
0x77e10000	0x57000	4.00.1381.0335	C:\WINNT\system32\RPCRT4.dll

WINLOGON.EXE pid: 46

Steven G Lukacs
GCFA Practical Assignment

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Command line: winlogon.exe

Base	Size	Version	Path
0x01000000	0x33000		\\?\C:\WINNT\system32\winlogon.exe
0x77f60000	0x5e000	4.00.1381.0298	C:\WINNT\System32\ntdll.dll
0x78000000	0x40000	6.00.8397.0000	C:\WINNT\system32\MSVCRT.dll
0x77f00000	0x5e000	4.00.1381.0300	C:\WINNT\system32\KERNEL32.dll
0x77dc0000	0x3f000	4.00.1381.0281	C:\WINNT\system32\ADVAPI32.dll
0x77e70000	0x55000	4.00.1381.0310	C:\WINNT\system32\USER32.dll
0x77ed0000	0x2c000	4.00.1381.0298	C:\WINNT\system32\GDI32.dll
0x77e10000	0x57000	4.00.1381.0335	C:\WINNT\system32\RPCRT4.dll
0x74880000	0x14000	4.00.1381.0307	C:\WINNT\system32\USERENV.dll
0x77c40000	0x13c000	4.00.1381.0332	C:\WINNT\system32\SHELL32.dll
0x71700000	0x8a000	5.81.4134.0600	C:\WINNT\system32\COMCTL32.dll
0x77800000	0x3a000	4.00.1381.0164	C:\WINNT\system32\NETAPI32.dll
0x77840000	0x9000	4.00.1371.0001	C:\WINNT\system32\NETRAP.dll
0x777e0000	0xd000	4.00.1381.0164	C:\WINNT\system32\SAMLIB.dll
0x77fd0000	0x2a000	4.00.1371.0001	C:\WINNT\system32\WINMM.dll
0x75c90000	0x21000	4.00.1381.0295	C:\WINNT\system32\msgina.dll
0x77e00000	0x6000	4.00.1381.0319	C:\WINNT\system32\rpcclts1.dll
0x77bf0000	0x7000	4.00.1381.0319	C:\WINNT\system32\rpccltc1.dll
0x00f40000	0xd000	6.00.0002.2188	C:\PROGRA~1\Sybase\ADAPTI~1.0\win32\dbctr6.dll
0x42c20000	0xe000	2000.02.0008.0000	C:\WINNT\system32\SQLCTR70.DLL
0x74a00000	0x6000	4.00.1381.0164	C:\WINNT\system32\tapiperf.dll
0x75460000	0xf000	4.00.1381.0279	C:\WINNT\system32\Perfctrs.dll
0x74ba0000	0x9000	4.00.1381.0164	C:\WINNT\system32\snmpapi.dll
0x776d0000	0x8000	4.00.1381.0300	C:\WINNT\system32\WSOCK32.dll
0x776b0000	0x14000	4.00.1381.0282	C:\WINNT\system32\WS2_32.dll
0x776a0000	0x7000	4.00.1381.0164	C:\WINNT\system32\WS2HELP.dll
0x76a90000	0xf000	4.00.1381.0279	C:\WINNT\system32\INETMIB1.DLL

SERVICES.EXE pid: 48

Command line: C:\WINNT\system32\services.exe

Base	Size	Version	Path
0x02290000	0x24000	4.00.1381.0164	C:\WINNT\system32\services.exe
0x77f60000	0x5e000	4.00.1381.0298	C:\WINNT\System32\ntdll.dll
0x77e10000	0x57000	4.00.1381.0335	C:\WINNT\system32\RPCRT4.dll
0x77f00000	0x5e000	4.00.1381.0300	C:\WINNT\system32\KERNEL32.dll
0x77dc0000	0x3f000	4.00.1381.0281	C:\WINNT\system32\ADVAPI32.dll
0x77e70000	0x55000	4.00.1381.0310	C:\WINNT\system32\USER32.dll
0x77ed0000	0x2c000	4.00.1381.0298	C:\WINNT\system32\GDI32.dll
0x74900000	0x1a000	4.00.1381.0164	C:\WINNT\system32\umpnpgmgr.dll
0x78000000	0x40000	6.00.8397.0000	C:\WINNT\system32\MSVCRT.dll
0x74880000	0x14000	4.00.1381.0307	C:\WINNT\system32\USERENV.dll
0x77c40000	0x13c000	4.00.1381.0332	C:\WINNT\system32\SHELL32.dll
0x71700000	0x8a000	5.81.4134.0600	C:\WINNT\system32\COMCTL32.dll
0x77800000	0x3a000	4.00.1381.0164	C:\WINNT\system32\NETAPI32.dll
0x77840000	0x9000	4.00.1371.0001	C:\WINNT\system32\NETRAP.dll
0x777e0000	0xd000	4.00.1381.0164	C:\WINNT\system32\SAMLIB.dll
0x77bf0000	0x7000	4.00.1381.0319	C:\WINNT\system32\rpccltc1.dll
0x77e00000	0x6000	4.00.1381.0319	C:\WINNT\system32\rpcclts1.dll
0x76e00000	0xf000	4.00.1381.0300	C:\WINNT\system32\eventlog.dll
0x77fd0000	0x2a000	4.00.1371.0001	C:\WINNT\system32\WINMM.dll
0x74b40000	0x1c000	4.00.1381.0327	C:\WINNT\system32\Srvsvc.dll
0x758b0000	0x6000	4.00.1381.0164	C:\WINNT\system32\ntlsapi.dll

0x77c00000	0x18000	4.00.1381.0314	C:\WINNT\system32\WINSPOOL.DRV
0x74450000	0x1c000	4.00.1381.0327	C:\WINNT\system32\XACTSRV.dll
0x773e0000	0xe000	4.00.1371.0001	C:\WINNT\system32\browser.dll
0x745e0000	0x11000	4.00.1381.0317	C:\WINNT\system32\wkssvc.dll
0x765e0000	0x7000	4.00.1381.0316	C:\WINNT\system32\lmhsvc.dll
0x776b0000	0x14000	4.00.1381.0282	C:\WINNT\system32\WS2_32.dll
0x776a0000	0x7000	4.00.1381.0164	C:\WINNT\system32\WS2HELP.dll
0x76b10000	0x7000	4.00.1371.0001	C:\WINNT\system32\ICMP.dll
0x758c0000	0xb000	4.00.1381.0336	C:\WINNT\system32\ntlmssps.dll
0x774d0000	0x8000	4.00.1374.0001	C:\WINNT\system32\alrsvc.dll
0x75c80000	0xc000	4.00.1381.0164	C:\WINNT\system32\msgsvc.dll
0x74620000	0x7000	4.00.1381.0282	C:\WINNT\system32\winsrpc.dll
0x74fc0000	0xf000	4.00.1381.0319	C:\WINNT\system32\RpcLtCcm.Dll
0x776d0000	0x8000	4.00.1381.0300	C:\WINNT\system32\WSOCK32.dll
0x77670000	0x15000	4.00.1381.0300	C:\WINNT\system32\MSWSOCK.DLL
0x74ff0000	0xe000	4.00.1381.0300	C:\WINNT\System32\rnr20.dll
0x77660000	0xf000	4.00.1381.0164	C:\WINNT\system32\msafsd.dll
0x77690000	0x9000	4.00.1381.0297	C:\WINNT\System32\wshtcpip.dll

LSASS.EXE pid: 51

Command line: C:\WINNT\system32\lsass.exe

Base	Size	Version	Path
0x018e0000	0x6000	4.00.1381.0324	C:\WINNT\system32\lsass.exe
0x77f60000	0x5e000	4.00.1381.0298	C:\WINNT\System32\ntdll.dll
0x77f00000	0x5e000	4.00.1381.0300	C:\WINNT\system32\KERNEL32.dll
0x76520000	0x29000	4.00.1381.0324	C:\WINNT\system32\LSASRV.dll
0x78000000	0x40000	6.00.8397.0000	C:\WINNT\system32\MSVCRT.dll
0x77e10000	0x57000	4.00.1381.0335	C:\WINNT\system32\RPCRT4.dll
0x77dc0000	0x3f000	4.00.1381.0281	C:\WINNT\system32\ADVAPI32.dll
0x77e70000	0x55000	4.00.1381.0310	C:\WINNT\system32\USER32.dll
0x77ed0000	0x2c000	4.00.1381.0298	C:\WINNT\system32\GDI32.dll
0x74f50000	0x2e000	4.00.1381.0275	C:\WINNT\system32\SAMSRV.dll
0x75c20000	0xc000	4.00.1381.0164	C:\WINNT\system32\msprivs.dll
0x73680000	0x31000	4.00.1381.0294	C:\WINNT\system32\Netlogon.dll
0x77800000	0x3a000	4.00.1381.0164	C:\WINNT\system32\NETAPI32.dll
0x77840000	0x9000	4.00.1371.0001	C:\WINNT\system32\NETRAP.dll
0x777e0000	0xd000	4.00.1381.0164	C:\WINNT\system32\SAMLIB.dll
0x75b80000	0xf000	4.00.1381.0307	C:\WINNT\system32\msv1_0.dll
0x77e00000	0x6000	4.00.1381.0319	C:\WINNT\system32\rpccls1.dll
0x77bf0000	0x7000	4.00.1381.0319	C:\WINNT\system32\rpccltc1.dll
0x76e70000	0x12000	4.00.1381.0336	C:\WINNT\system32\security.dll
0x71870000	0x14000	6.00.0000.7755	C:\WINNT\system32\msapsspc.dll
0x779d0000	0x15000	4.2000.0000.6172	C:\WINNT\system32\MSVCRT40.dll
0x780a0000	0x12000	6.00.8168.0000	C:\WINNT\system32\MSVCIRT.dll
0x77400000	0x21000	4.87.1959.1877	C:\WINNT\system32\schannel.dll
0x5e380000	0x25000	5.131.1877.0003	C:\WINNT\system32\MSOSS.dll
0x776d0000	0x8000	4.00.1381.0300	C:\WINNT\system32\WSOCK32.dll
0x776b0000	0x14000	4.00.1381.0282	C:\WINNT\system32\WS2_32.dll
0x776a0000	0x7000	4.00.1381.0164	C:\WINNT\system32\WS2HELP.dll
0x5cf00000	0x5e000	5.131.1877.0005	C:\WINNT\system32\CRYPT32.dll
0x71840000	0x1f000	6.00.0000.7753	C:\WINNT\system32\msnsspc.dll
0x60900000	0xe000	5.50.4134.0600	C:\WINNT\system32\digest.dll
0x77720000	0x11000	4.00.1381.0289	C:\WINNT\system32\mpr.dll

SPOOLSS.EXE pid: 77

Command line: C:\WINNT\system32\spoolss.exe

Base	Size	Version	Path
0x02440000	0xc000	4.00.1381.0164	C:\WINNT\system32\spoolss.exe
0x77f60000	0x5e000	4.00.1381.0298	C:\WINNT\System32\ntdll.dll
0x78000000	0x40000	6.00.8397.0000	C:\WINNT\system32\MSVCRT.dll
0x77f00000	0x5e000	4.00.1381.0300	C:\WINNT\system32\KERNEL32.dll
0x77dc0000	0x3f000	4.00.1381.0281	C:\WINNT\system32\ADVAPI32.dll
0x77e70000	0x55000	4.00.1381.0310	C:\WINNT\system32\USER32.dll
0x77ed0000	0x2c000	4.00.1381.0298	C:\WINNT\system32\GDI32.dll
0x77e10000	0x57000	4.00.1381.0335	C:\WINNT\system32\RPCRT4.dll
0x74b60000	0xf000	4.00.1381.0164	C:\WINNT\system32\SPOOLSS.DLL
0x77bf0000	0x7000	4.00.1381.0319	C:\WINNT\system32\rpccltc1.dll
0x77e00000	0x6000	4.00.1381.0319	C:\WINNT\system32\rpcclts1.dll
0x76580000	0x27000	4.00.1381.0321	C:\WINNT\system32\localspl.dll
0x776b0000	0x14000	4.00.1381.0282	C:\WINNT\system32\WS2_32.dll
0x776a0000	0x7000	4.00.1381.0164	C:\WINNT\system32\WS2HELP.dll
0x77a90000	0xb000	4.00.1371.0001	C:\WINNT\system32\VERSION.dll
0x77c40000	0x13c000	4.00.1381.0332	C:\WINNT\system32\SHELL32.dll
0x71700000	0x8a000	5.81.4134.0600	C:\WINNT\system32\COMCTL32.dll
0x779c0000	0x8000	4.00.1371.0001	C:\WINNT\system32\LZ32.dll
0x76ac0000	0x1d000	4.00.1381.0125	C:\WINNT\system32\IMAGEHLP.dll
0x77c00000	0x18000	4.00.1381.0314	C:\WINNT\system32\winspool.drv
0x77800000	0x3a000	4.00.1381.0164	C:\WINNT\system32\netapi32.dll
0x77840000	0x9000	4.00.1371.0001	C:\WINNT\system32\NETRAP.dll
0x777e0000	0xd000	4.00.1381.0164	C:\WINNT\system32\SAMLIB.dll
0x765b0000	0x7000	4.00.1381.0279	C:\WINNT\system32\localmon.dll
0x75430000	0x7000	4.00.1371.0001	C:\WINNT\system32\pjlmon.dll
0x74660000	0x8000	4.00.1381.0164	
C:\WINNT\System32\spool\PRTPROCS\W32X86\winprint.dll			
0x74670000	0x1e000	4.00.1381.0273	C:\WINNT\system32\win32spl.dll

NETDDE.EXE pid: 82

Command line: C:\WINNT\system32\netdde.exe

Base	Size	Version	Path
0x01b00000	0x20000	4.00.1381.0306	C:\WINNT\system32\netdde.exe
0x77f60000	0x5e000	4.00.1381.0298	C:\WINNT\System32\ntdll.dll
0x78000000	0x40000	6.00.8397.0000	C:\WINNT\system32\MSVCRT.dll
0x77f00000	0x5e000	4.00.1381.0300	C:\WINNT\system32\KERNEL32.dll
0x77dc0000	0x3f000	4.00.1381.0281	C:\WINNT\system32\ADVAPI32.dll
0x77e70000	0x55000	4.00.1381.0310	C:\WINNT\system32\USER32.dll
0x77ed0000	0x2c000	4.00.1381.0298	C:\WINNT\system32\GDI32.dll
0x77e10000	0x57000	4.00.1381.0335	C:\WINNT\system32\RPCRT4.dll
0x775a80000	0x7000	4.00.1381.0164	C:\WINNT\system32\NDdeApi.dll
0x77bf0000	0x7000	4.00.1381.0319	C:\WINNT\system32\rpccltc1.dll
0x77e00000	0x6000	4.00.1381.0319	C:\WINNT\system32\rpcclts1.dll

NETDDE.EXE pid: 91

Command line: netdde

Base	Size	Version	Path
0x01b00000	0x20000	4.00.1381.0306	C:\WINNT\system32\NETDDE.EXE
0x77f60000	0x5e000	4.00.1381.0298	C:\WINNT\System32\ntdll.dll
0x78000000	0x40000	6.00.8397.0000	C:\WINNT\system32\MSVCRT.dll
0x77f00000	0x5e000	4.00.1381.0300	C:\WINNT\system32\KERNEL32.dll

0x77dc0000	0x3f000	4.00.1381.0281	C:\WINNT\system32\ADVAPI32.dll
0x77e70000	0x55000	4.00.1381.0310	C:\WINNT\system32\USER32.dll
0x77ed0000	0x2c000	4.00.1381.0298	C:\WINNT\system32\GDI32.dll
0x77e10000	0x57000	4.00.1381.0335	C:\WINNT\system32\RPCRT4.dll
0x75a80000	0x7000	4.00.1381.0164	C:\WINNT\system32\NDdeApi.dll
0x77bf0000	0x7000	4.00.1381.0319	C:\WINNT\system32\rpcrtc1.dll
0x75a70000	0x9000	4.00.1381.0164	C:\WINNT\system32\NDDENB32.dll
0x77800000	0x3a000	4.00.1381.0164	C:\WINNT\system32\NETAPI32.dll
0x77840000	0x9000	4.00.1371.0001	C:\WINNT\system32\NETRAP.dll
0x777e0000	0xd000	4.00.1381.0164	C:\WINNT\system32\SAMLIB.dll

wscript.exe pid: 103

Command line: C:\WINNT\System32\WScript.exe "C:\WINNT\system32\sqlprocess.js"

Base	Size	Version	Path
0x00400000	0x16000	5.01.0000.4615	C:\WINNT\System32\WScript.exe
0x77f60000	0x5e000	4.00.1381.0298	C:\WINNT\System32\ntdll.dll
0x77dc0000	0x3f000	4.00.1381.0281	C:\WINNT\system32\ADVAPI32.dll
0x77f00000	0x5e000	4.00.1381.0300	C:\WINNT\system32\KERNEL32.dll
0x77e70000	0x55000	4.00.1381.0310	C:\WINNT\system32\USER32.dll
0x77ed0000	0x2c000	4.00.1381.0298	C:\WINNT\system32\GDI32.dll
0x77e10000	0x57000	4.00.1381.0335	C:\WINNT\system32\RPCRT4.dll
0x77b20000	0xb7000	4.00.1381.0326	C:\WINNT\system32\ole32.dll
0x65340000	0x92000	2.40.4277.0001	C:\WINNT\system32\OLEAUT32.dll
0x70290000	0x73000	5.50.4134.0600	C:\WINNT\system32\urlmon.dll
0x70bd0000	0x4c000	5.50.4134.0600	C:\WINNT\system32\SHLWAPI.dll
0x77a90000	0xb000	4.00.1371.0001	C:\WINNT\system32\VERSION.dll
0x77c40000	0x13c000	4.00.1381.0332	C:\WINNT\system32\SHELL32.dll
0x71700000	0x8a000	5.81.4134.0600	C:\WINNT\system32\COMCTL32.dll
0x779c0000	0x8000	4.00.1371.0001	C:\WINNT\system32\LZ32.dll
0x76ab0000	0x5000	4.00.1381.0001	C:\WINNT\System32\IMM32.dll
0x78000000	0x40000	6.00.8397.0000	C:\WINNT\system32\MSVCRT.dll
0x712b0000	0x87000	5.05.0000.5207	C:\WINNT\System32\jscript.dll
0x10000000	0x12000	5.01.0000.4615	C:\WINNT\System32\wshom.ocx
0x77c00000	0x18000	4.00.1381.0314	C:\WINNT\System32\WINSPOOL.DRV
0x77720000	0x11000	4.00.1381.0289	C:\WINNT\system32\MPR.dll
0x6b800000	0x24000	5.01.0000.5010	C:\WINNT\System32\scrrun.dll
0x71810000	0x17000	5.50.4134.0600	C:\WINNT\system32\url.dll
0x11000000	0x5000	1.00.0000.0000	C:\WINNT\system32\timer.dll
0x66000000	0x158000	6.00.0082.0068	C:\WINNT\system32\MSVBVM60.DLL

RPCSS.EXE pid: 194

Command line: C:\WINNT\system32\RpcSs.exe

Base	Size	Version	Path
0x02170000	0x1d000	4.00.1381.0327	C:\WINNT\system32\RpcSs.exe
0x77f60000	0x5e000	4.00.1381.0298	C:\WINNT\System32\ntdll.dll
0x78000000	0x40000	6.00.8397.0000	C:\WINNT\system32\MSVCRT.dll
0x77f00000	0x5e000	4.00.1381.0300	C:\WINNT\system32\KERNEL32.dll
0x77dc0000	0x3f000	4.00.1381.0281	C:\WINNT\system32\ADVAPI32.dll
0x77e70000	0x55000	4.00.1381.0310	C:\WINNT\system32\USER32.dll
0x77ed0000	0x2c000	4.00.1381.0298	C:\WINNT\system32\GDI32.dll
0x77e10000	0x57000	4.00.1381.0335	C:\WINNT\system32\RPCRT4.dll
0x776d0000	0x8000	4.00.1381.0300	C:\WINNT\system32\WSOCK32.dll
0x776b0000	0x14000	4.00.1381.0282	C:\WINNT\system32\WS2_32.dll
0x776a0000	0x7000	4.00.1381.0164	C:\WINNT\system32\WS2HELP.dll

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0x77670000 0x15000 4.00.1381.0300 C:\WINNT\system32\MSWSOCK.DLL
0x776e70000 0x12000 4.00.1381.0336 C:\WINNT\system32\SECURITY.dll
0x777bf0000 0x7000 4.00.1381.0319 C:\WINNT\system32\rpcltc1.dll
0x71870000 0x14000 6.00.0000.7755 C:\WINNT\system32\msapsspc.dll
0x779d0000 0x15000 4.2000.0000.6172 C:\WINNT\system32\MSVCRT40.dll
0x780a0000 0x12000 6.00.8168.0000 C:\WINNT\system32\MSVCIRT.dll
0x77440000 0x21000 4.87.1959.1877 C:\WINNT\system32\schannel.dll
0x5e380000 0x25000 5.131.1877.0003 C:\WINNT\system32\MSOSS.dll
0x5cf00000 0x5e000 5.131.1877.0005 C:\WINNT\system32\CRYPT32.dll
0x71840000 0x1f000 6.00.0000.7753 C:\WINNT\system32\msnsspc.dll
0x60900000 0xe000 5.50.4134.0600 C:\WINNT\system32\digest.dll
0x74fa0000 0xb000 4.00.1381.0319 C:\WINNT\system32\RpcLtScm.Dll
0x77660000 0xf000 4.00.1381.0164 C:\WINNT\system32\msafd.dll
0x77690000 0x9000 4.00.1381.0297 C:\WINNT\System32\wshtcpip.dll
0x74ff0000 0xe000 4.00.1381.0300 C:\WINNT\System32\rnr20.dll
0x77e00000 0x6000 4.00.1381.0319 C:\WINNT\system32\rpclts1.dll

```

msdtc.exe pid: 202

Command line: C:\WINNT\System32\msdtc.exe

Base	Size	Version	Path
0x00400000	0x4000	1999.06.0854.0000	C:\WINNT\System32\msdtc.exe
0x77f60000	0x5e000	4.00.1381.0298	C:\WINNT\System32\ntdll.dll
0x78000000	0x40000	6.00.8397.0000	C:\WINNT\system32\MSVCRT.dll
0x77f00000	0x5e000	4.00.1381.0300	C:\WINNT\system32\KERNEL32.dll
0x69400000	0x9000	1999.06.0854.0000	C:\WINNT\System32\MSDTC.DLL
0x77e70000	0x55000	4.00.1381.0310	C:\WINNT\system32\USER32.dll
0x77ed0000	0x2c000	4.00.1381.0298	C:\WINNT\system32\GDI32.dll
0x77dc0000	0x3f000	4.00.1381.0281	C:\WINNT\system32\ADVAPI32.dll
0x77e10000	0x57000	4.00.1381.0335	C:\WINNT\system32\RPCRT4.dll
0x69380000	0x2a000	1999.06.0854.0000	C:\WINNT\System32\DtcXaTm.dll
0x77b20000	0xb7000	4.00.1381.0326	C:\WINNT\system32\ole32.dll
0x780a0000	0x12000	6.00.8168.0000	C:\WINNT\System32\MSVCIRT.dll
0x69120000	0x13000	1999.06.0854.0000	C:\WINNT\System32\ADME.dll
0x69000000	0xa000	1999.06.0854.0000	C:\WINNT\System32\DTCUtil.dll
0x68ff0000	0x7000	1999.06.0854.0000	C:\WINNT\System32\DTCTRACE.dll
0x69790000	0xd000	1999.06.0854.0000	C:\WINNT\System32\MTXCLU.DLL
0x77a90000	0xb000	4.00.1371.0001	C:\WINNT\system32\VERSION.dll
0x77c40000	0x13c000	4.00.1381.0332	C:\WINNT\system32\SHELL32.dll
0x71700000	0x8a000	5.81.4134.0600	C:\WINNT\system32\COMCTL32.dll
0x779c0000	0x8000	4.00.1371.0001	C:\WINNT\system32\LZ32.dll
0x69360000	0x9000	1999.06.0854.0000	C:\WINNT\System32\XOLEHLP.dll
0x690b0000	0x1e000	1999.06.0854.0000	C:\WINNT\System32\DTCCM.dll
0x69050000	0xf000	1999.06.0854.0000	C:\WINNT\System32\DTCUIS.dll
0x69160000	0x13000	1999.06.0854.0000	C:\WINNT\System32\LOGMGR.dll
0x69190000	0x84000	1999.06.0854.0000	C:\WINNT\System32\MSDTCM.dll
0x7f230000	0xd000	1.00.0224.0006	C:\WINNT\System32\CLUSAPI.DLL
0x7f250000	0xa000	1.00.0224.0006	C:\WINNT\System32\RESUTILS.DLL
0x69a40000	0x1b000	1999.06.0854.0000	C:\WINNT\System32\MTxOCI.Dll
0x69a20000	0xb000	1999.06.0902.0000	C:\WINNT\System32\MtxDm.dll
0x69140000	0x17000	1999.06.0854.0000	C:\WINNT\System32\ENUdte.dll
0x77bf0000	0x7000	4.00.1381.0319	C:\WINNT\System32\rpcltc1.dll
0x74fa0000	0xb000	4.00.1381.0319	C:\WINNT\System32\RpcLtScm.Dll
0x776d0000	0x8000	4.00.1381.0300	C:\WINNT\system32\WSOCK32.dll
0x776b0000	0x14000	4.00.1381.0282	C:\WINNT\system32\WS2_32.dll
0x776a0000	0x7000	4.00.1381.0164	C:\WINNT\system32\WS2HELP.dll

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0x77670000 0x15000 4.00.1381.0300 C:\WINNT\System32\MSWSOCK.DLL
0x77660000 0xf000 4.00.1381.0164 C:\WINNT\system32\msafd.dll
0x77690000 0x9000 4.00.1381.0297 C:\WINNT\System32\wshtcpip.dll
0x74ff0000 0xe000 4.00.1381.0300 C:\WINNT\System32\rnr20.dll
0x74fc0000 0xf000 4.00.1381.0319 C:\WINNT\System32\RpcLtCcm.Dll

```

sqlservr.exe pid: 258

Command line: C:\MSSQL7\binn\sqlservr.exe

Base	Size	Version	Path
0x00400000	0x4ca000	2000.03.0002.0000	C:\MSSQL7\binn\sqlservr.exe
0x77f60000	0x5e000	4.00.1381.0298	C:\WINNT\System32\ntdll.dll
0x77f00000	0x5e000	4.00.1381.0300	C:\WINNT\system32\KERNEL32.dll
0x77dc0000	0x3f000	4.00.1381.0281	C:\WINNT\system32\ADVAPI32.dll
0x77e70000	0x55000	4.00.1381.0310	C:\WINNT\system32\USER32.dll
0x77ed0000	0x2c000	4.00.1381.0298	C:\WINNT\system32\GDI32.dll
0x77e10000	0x57000	4.00.1381.0335	C:\WINNT\system32\RPCRT4.dll
0x77b20000	0xb7000	4.00.1381.0326	C:\WINNT\system32\ole32.dll
0x65340000	0x92000	2.40.4277.0001	C:\WINNT\system32\OLEAUT32.dll
0x77a90000	0xb000	4.00.1371.0001	C:\WINNT\system32\VERSION.dll
0x77c40000	0x13c000	4.00.1381.0332	C:\WINNT\system32\SHELL32.dll
0x71700000	0x8a000	5.81.4134.0600	C:\WINNT\system32\COMCTL32.dll
0x779c0000	0x8000	4.00.1371.0001	C:\WINNT\system32\LZ32.dll
0x41060000	0x26000	2000.02.0008.0000	C:\MSSQL7\binn\opends60.dll
0x41090000	0xd000	2000.02.0008.0000	C:\MSSQL7\binn\ums.dll
0x78000000	0x40000	6.00.8397.0000	C:\WINNT\system32\MSVCRT.dll
0x1b5c0000	0x95000	4.00.3829.0000	C:\WINNT\system32\mswstr10.dll
0x780a0000	0x12000	6.00.8168.0000	C:\WINNT\system32\MSVCIRT.dll
0x410a0000	0x7000	1998.11.0013.0000	C:\MSSQL7\binn\sqllevn70.dll
0x77bf0000	0x7000	4.00.1381.0319	C:\WINNT\system32\rpctlc1.dll
0x410b0000	0x4f000	2000.02.0008.0000	C:\MSSQL7\binn\COMNEVNT.DLL
0x1f7d0000	0x34000	3.520.4403.0002	C:\WINNT\system32\ODBC32.dll
0x77d80000	0x32000	4.00.1381.0319	C:\WINNT\system32\comdlg32.dll
0x41100000	0xc000	1999.10.0020.0000	C:\WINNT\system32\SQLWOA.dll
0x1f8c0000	0x16000	3.520.4403.0002	C:\WINNT\system32\odbcint.dll
0x75a80000	0x7000	4.00.1381.0164	C:\WINNT\system32\NDDEAPI.DLL
0x77c00000	0x18000	4.00.1381.0314	C:\WINNT\system32\WINSPOOL.DRV
0x41130000	0x4e000	2000.02.0008.0000	C:\MSSQL7\binn\SQLTrace.DLL
0x77800000	0x3a000	4.00.1381.0164	C:\WINNT\system32\NETAPI32.DLL
0x77840000	0x9000	4.00.1371.0001	C:\WINNT\system32\NETRAP.dll
0x777e0000	0xd000	4.00.1381.0164	C:\WINNT\system32\SAMLIB.dll
0x41190000	0x6000	1999.04.0012.0000	C:\MSSQL7\binn\SSNMPN70.dll
0x411a0000	0xb000	1999.04.0012.0000	C:\MSSQL7\binn\SSMSSO70.dll
0x776d0000	0x8000	4.00.1381.0300	C:\WINNT\system32\WSOCK32.dll
0x776b0000	0x14000	4.00.1381.0282	C:\WINNT\system32\WS2_32.dll
0x776a0000	0x7000	4.00.1381.0164	C:\WINNT\system32\WS2HELP.dll
0x411b0000	0x8000	2000.02.0008.0000	C:\MSSQL7\binn\SSMSRP70.dll
0x77660000	0xf000	4.00.1381.0164	C:\WINNT\system32\msafd.dll
0x77690000	0x9000	4.00.1381.0297	C:\WINNT\System32\wshtcpip.dll
0x77e00000	0x6000	4.00.1381.0319	C:\WINNT\system32\rpclts1.dll
0x74fa0000	0xb000	4.00.1381.0319	C:\WINNT\system32\RpcLtScm.Dll
0x77670000	0x15000	4.00.1381.0300	C:\WINNT\system32\MSWSOCK.DLL
0x74ff0000	0xe000	4.00.1381.0300	C:\WINNT\System32\rnr20.dll
0x74fc0000	0xf000	4.00.1381.0319	C:\WINNT\system32\RpcLtCcm.Dll
0x76e70000	0x12000	4.00.1381.0336	C:\WINNT\system32\security.dll
0x71870000	0x14000	6.00.0000.7755	C:\WINNT\system32\msapsspc.dll

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0x779d0000 0x15000 4.2000.0000.6172 C:\WINNT\system32\MSVCRT40.dll
0x77400000 0x21000 4.87.1959.1877 C:\WINNT\system32\schannel.dll
0x5e380000 0x25000 5.131.1877.0003 C:\WINNT\system32\MSOSS.dll
0x5cf00000 0x5e000 5.131.1877.0005 C:\WINNT\system32\CRYPT32.dll
0x71840000 0x1f000 6.00.0000.7753 C:\WINNT\system32\msnsspc.dll
0x60900000 0xe000 5.50.4134.0600 C:\WINNT\system32\digest.dll
0x411c0000 0x5000 C:\MSSQL7\binn\SQLRGSTR.DLL
0x41820000 0x6000 1998.11.0013.0000 C:\MSSQL7\binn\xpsqlbot.dll
0x417f0000 0x8000 1998.11.0013.0000 C:\MSSQL7\binn\sqlboot.dll

```

PSTORES.EXE pid: 264

Command line: c:\winnt\system32\pstores.exe

Base	Size	Version	Path
0x01000000	0x17000	5.00.1877.0003	c:\winnt\system32\pstores.exe
0x77f60000	0x5e000	4.00.1381.0298	C:\WINNT\System32\ntdll.dll
0x77dc0000	0x3f000	4.00.1381.0281	C:\WINNT\system32\ADVAPI32.dll
0x77f00000	0x5e000	4.00.1381.0300	C:\WINNT\system32\KERNEL32.dll
0x77e70000	0x55000	4.00.1381.0310	C:\WINNT\system32\USER32.dll
0x77ed0000	0x2c000	4.00.1381.0298	C:\WINNT\system32\GDI32.dll
0x77e10000	0x57000	4.00.1381.0335	C:\WINNT\system32\RPCRT4.dll
0x77bf0000	0x7000	4.00.1381.0319	c:\winnt\system32\rpccltc1.dll
0x76ac0000	0x1d000	4.00.1381.0125	c:\winnt\system32\imagehlp.dll
0x47600000	0xe000	5.131.1877.0005	c:\winnt\system32\wintrust.dll
0x78000000	0x40000	6.00.8397.0000	C:\WINNT\system32\MSVCRT.dll
0x5cf00000	0x5e000	5.131.1877.0005	c:\winnt\system32\CRYPT32.dll
0x5e380000	0x25000	5.131.1877.0003	c:\winnt\system32\MSOSS.dll
0x47a80000	0x11000	5.131.1877.0004	c:\winnt\system32\SOFTPUB.DLL
0x77b20000	0xb7000	4.00.1381.0326	C:\WINNT\system32\ole32.dll
0x60000000	0xd000	5.00.1877.0005	c:\winnt\system32\pstorerc.dll
0x5a880000	0x13000	5.00.1877.0005	c:\winnt\system32\psbase.dll
0x77a90000	0xb000	4.00.1371.0001	C:\WINNT\system32\VERSION.dll
0x77c40000	0x13c000	4.00.1381.0332	C:\WINNT\system32\SHELL32.dll
0x71700000	0x8a000	5.81.4134.0600	C:\WINNT\system32\COMCTL32.dll
0x779c0000	0x8000	4.00.1371.0001	C:\WINNT\system32\LZ32.dll

LOCATOR.EXE pid: 267

Command line: C:\WINNT\System32\LOCATOR.EXE

Base	Size	Version	Path
0x01880000	0x20000	4.00.1381.0288	C:\WINNT\System32\LOCATOR.EXE
0x77f60000	0x5e000	4.00.1381.0298	C:\WINNT\System32\ntdll.dll
0x77dc0000	0x3f000	4.00.1381.0281	C:\WINNT\system32\ADVAPI32.dll
0x77f00000	0x5e000	4.00.1381.0300	C:\WINNT\system32\KERNEL32.dll
0x77e70000	0x55000	4.00.1381.0310	C:\WINNT\system32\USER32.dll
0x77ed0000	0x2c000	4.00.1381.0298	C:\WINNT\system32\GDI32.dll
0x77e10000	0x57000	4.00.1381.0335	C:\WINNT\system32\RPCRT4.dll
0x77800000	0x3a000	4.00.1381.0164	C:\WINNT\system32\NETAPI32.dll
0x78000000	0x40000	6.00.8397.0000	C:\WINNT\system32\MSVCRT.dll
0x77840000	0x9000	4.00.1371.0001	C:\WINNT\system32\NETRAP.dll
0x777e0000	0xd000	4.00.1381.0164	C:\WINNT\system32\SAMLIB.dll
0x77bf0000	0x7000	4.00.1381.0319	C:\WINNT\System32\rpccltc1.dll
0x77e00000	0x6000	4.00.1381.0319	C:\WINNT\System32\rpcclts1.dll

sqlagent.exe pid: 87

Command line: C:\MSSQL7\binn\sqlagent.exe

Base	Size	Version	Path
0x00400000	0x57000	2000.02.0008.0000	C:\MSSQL7\binn\sqlagent.exe
0x77f60000	0x5e000	4.00.1381.0298	C:\WINNT\System32\ntdll.dll
0x41100000	0xc000	1999.10.0020.0000	C:\WINNT\system32\SQLWOA.dll
0x77e70000	0x55000	4.00.1381.0310	C:\WINNT\system32\USER32.dll
0x77f00000	0x5e000	4.00.1381.0300	C:\WINNT\system32\KERNEL32.dll
0x77ed0000	0x2c000	4.00.1381.0298	C:\WINNT\system32\GDI32.dll
0x77dc0000	0x3f000	4.00.1381.0281	C:\WINNT\system32\ADVAPI32.dll
0x77e10000	0x57000	4.00.1381.0335	C:\WINNT\system32\RPCRT4.dll
0x78000000	0x40000	6.00.8397.0000	C:\WINNT\system32\MSVCRT.dll
0x77d80000	0x32000	4.00.1381.0319	C:\WINNT\system32\comdlg32.dll
0x77c40000	0x13c000	4.00.1381.0332	C:\WINNT\system32\SHELL32.dll
0x71700000	0x8a000	5.81.4134.0600	C:\WINNT\system32\COMCTL32.dll
0x412f0000	0x6000	1999.10.0020.0000	C:\WINNT\system32\SQLWID.dll
0x415e0000	0x19000	2000.02.0008.0000	C:\MSSQL7\binn\SQLSVC.dll
0x1f7d0000	0x34000	3.520.4403.0002	C:\WINNT\system32\ODBC32.dll
0x41220000	0x6000	3.70.0008.0020	C:\WINNT\system32\odbcbcpl.dll
0x77a90000	0xb000	4.00.1371.0001	C:\WINNT\system32\VERSION.dll
0x779c0000	0x8000	4.00.1371.0001	C:\WINNT\system32\LZ32.dll
0x77b20000	0xb7000	4.00.1381.0326	C:\WINNT\system32\ole32.dll
0x41320000	0x6000	1998.11.0013.0000	C:\MSSQL7\binn\SQLRESLD.dll
0x41210000	0x8000	1998.11.0013.0000	C:\MSSQL7\binn\W95SCM.dll
0x410b0000	0x4f000	2000.02.0008.0000	C:\MSSQL7\binn\COMNEVNT.dll
0x41330000	0xf000	1999.04.0012.0000	C:\MSSQL7\binn\SEMMAP.dll
0x776d0000	0x8000	4.00.1381.0300	C:\WINNT\system32\WSOCK32.dll
0x776b0000	0x14000	4.00.1381.0282	C:\WINNT\system32\WS2_32.dll
0x776a0000	0x7000	4.00.1381.0164	C:\WINNT\system32\WS2HELP.dll
0x1f8c0000	0x16000	3.520.4403.0002	C:\WINNT\system32\odbcint.dll
0x75a80000	0x7000	4.00.1381.0164	C:\WINNT\system32\NDDEAPI.DLL
0x77c00000	0x18000	4.00.1381.0314	C:\WINNT\system32\WINSPOOL.DRV
0x42480000	0x6000	1998.11.0013.0000	C:\MSSQL7\binn\Resources\1033\SQLSVC.RLL
0x77bf0000	0x7000	4.00.1381.0319	C:\WINNT\system32\rpcrtc1.dll
0x42420000	0x8000	1998.11.0013.0000	C:\MSSQL7\binn\Resources\1033\SEMMAP.RLL
0x41840000	0xa000	1999.04.0015.0000	C:\MSSQL7\binn\SQLAGENT.DLL
0x41230000	0x7e000	3.70.0008.0020	C:\WINNT\System32\SQLSRV32.dll
0x77800000	0x3a000	4.00.1381.0164	C:\WINNT\system32\NETAPI32.dll
0x77840000	0x9000	4.00.1371.0001	C:\WINNT\system32\NETRAP.dll
0x777e0000	0xd000	4.00.1381.0164	C:\WINNT\system32\SAMLIB.dll
0x65340000	0x92000	2.40.4277.0001	C:\WINNT\system32\OLEAUT32.dll
0x1f820000	0x1a000	3.520.4403.0002	C:\WINNT\system32\odbccp32.dll
0x41a50000	0xb000	1998.11.0013.0000	C:\MSSQL7\BINN\SQLCMDSS.DLL
0x419b0000	0xa000	1998.11.0013.0000	C:\MSSQL7\BINN\SQLREPSS.DLL
0x41a40000	0xa000	1998.11.0013.0000	C:\MSSQL7\BINN\SQLATXSS.DLL
0x41e70000	0x11000	1998.11.0013.0000	C:\MSSQL7\binn\AXSCPHST.DLL
0x42620000	0x7000	1998.11.0013.0000	C:\MSSQL7\binn\Resources\1033\AXSCPHST.RLL
0x73310000	0x8000	1999.10.0020.0000	C:\WINNT\system32\DBNMPNTW.DLL

services.exe pid: 136

Command line: "C:\WINNT\system32\drivers\services.exe" -q -c 10000 10.1.1.1-255.254 -p 1433 -o rdata.txt -z 100

Base	Size	Version	Path
0x00400000	0x9b000	1.01.0003.0000	C:\WINNT\system32\drivers\services.exe
0x77f60000	0x5e000	4.00.1381.0298	C:\WINNT\System32\ntdll.dll
0x77f00000	0x5e000	4.00.1381.0300	C:\WINNT\system32\KERNEL32.DLL

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GCFA Practical Assignment

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0x78000000 0x40000 6.00.8397.0000 C:\WINNT\system32\MSVCRT.dll
0x77e70000 0x55000 4.00.1381.0310 C:\WINNT\system32\USER32.dll
0x77ed0000 0x2c000 4.00.1381.0298 C:\WINNT\system32\GDI32.dll
0x77dc0000 0x3f000 4.00.1381.0281 C:\WINNT\system32\ADVAPI32.dll
0x77e10000 0x57000 4.00.1381.0335 C:\WINNT\system32\RPCRT4.dll
0x776b0000 0x14000 4.00.1381.0282 C:\WINNT\system32\WS2_32.dll
0x776a0000 0x7000 4.00.1381.0164 C:\WINNT\system32\WS2HELP.dll
0x77660000 0xf000 4.00.1381.0164 C:\WINNT\system32\msafsd.dll
0x77690000 0x9000 4.00.1381.0297 C:\WINNT\System32\wshtcpip.dll
0x776d0000 0x8000 4.00.1381.0300 C:\WINNT\system32\WSOCK32.dll

```

NDDEAGNT.EXE pid: 315
Command line: nddeagnt.exe

Base	Size	Version	Path
0x01a90000	0x6000	4.00.1381.0164	C:\WINNT\System32\nddeagnt.exe
0x77f60000	0x5e000	4.00.1381.0298	C:\WINNT\System32\ntdll.dll
0x75a80000	0x7000	4.00.1381.0164	C:\WINNT\System32\NDdeApi.dll
0x78000000	0x40000	6.00.8397.0000	C:\WINNT\system32\MSVCRT.dll
0x77f00000	0x5e000	4.00.1381.0300	C:\WINNT\system32\KERNEL32.dll
0x77e70000	0x55000	4.00.1381.0310	C:\WINNT\system32\USER32.dll
0x77ed0000	0x2c000	4.00.1381.0298	C:\WINNT\system32\GDI32.dll
0x77dc0000	0x3f000	4.00.1381.0281	C:\WINNT\system32\ADVAPI32.dll
0x77e10000	0x57000	4.00.1381.0335	C:\WINNT\system32\RPCRT4.dll
0x77bf0000	0x7000	4.00.1381.0319	C:\WINNT\System32\rpc1tc1.dll

EXPLORER.EXE pid: 221
Command line: Explorer.exe

Base	Size	Version	Path
0x01580000	0x3c000	4.00.1381.0282	C:\WINNT\Explorer.exe
0x77f60000	0x5e000	4.00.1381.0298	C:\WINNT\System32\ntdll.dll
0x77ed0000	0x2c000	4.00.1381.0298	C:\WINNT\system32\GDI32.dll
0x77f00000	0x5e000	4.00.1381.0300	C:\WINNT\system32\KERNEL32.dll
0x77e70000	0x55000	4.00.1381.0310	C:\WINNT\system32\USER32.dll
0x77dc0000	0x3f000	4.00.1381.0281	C:\WINNT\system32\ADVAPI32.dll
0x77e10000	0x57000	4.00.1381.0335	C:\WINNT\system32\RPCRT4.dll
0x77c40000	0x13c000	4.00.1381.0332	C:\WINNT\system32\SHELL32.dll
0x71700000	0x8a000	5.81.4134.0600	C:\WINNT\system32\COMCTL32.dll
0x77720000	0x11000	4.00.1381.0289	C:\WINNT\system32\MPR.dll
0x71810000	0x17000	5.50.4134.0600	C:\WINNT\System32\url.dll
0x70bd0000	0x4c000	5.50.4134.0600	C:\WINNT\system32\SHLWAPI.dll
0x779b0000	0x9000	4.00.1371.0001	C:\WINNT\System32\LinkInfo.dll
0x77a40000	0xd000	4.00.1381.0164	C:\WINNT\System32\ntshui.dll
0x78000000	0x40000	6.00.8397.0000	C:\WINNT\system32\MSVCRT.dll
0x77b20000	0xb7000	4.00.1381.0326	C:\WINNT\system32\ole32.dll
0x77800000	0x3a000	4.00.1381.0164	C:\WINNT\system32\NETAPI32.dll
0x77840000	0x9000	4.00.1371.0001	C:\WINNT\system32\NETRAP.dll
0x777e0000	0xd000	4.00.1381.0164	C:\WINNT\system32\SAMLIB.dll
0x77bf0000	0x7000	4.00.1381.0319	C:\WINNT\System32\rpc1tc1.dll
0x777f0000	0xc000	4.00.1381.0273	C:\WINNT\System32\ntlanman.dll
0x77890000	0x15000	4.00.1381.0316	C:\WINNT\System32\NETUI0.dll
0x77850000	0x3a000	4.00.1381.0316	C:\WINNT\System32\NETUI1.dll

PROMon.exe pid: 131
Command line: "C:\WINNT\System32\PROMon.exe"

Base	Size	Version	Path
0x00400000	0xb000	1.09.0000.0000	C:\WINNT\System32\PROMon.exe
0x77f60000	0x5e000	4.00.1381.0298	C:\WINNT\System32\ntdll.dll
0x77f00000	0x5e000	4.00.1381.0300	C:\WINNT\system32\KERNEL32.dll
0x77e70000	0x55000	4.00.1381.0310	C:\WINNT\system32\USER32.dll
0x77ed0000	0x2c000	4.00.1381.0298	C:\WINNT\system32\GDI32.dll
0x77dc0000	0x3f000	4.00.1381.0281	C:\WINNT\system32\ADVAPI32.dll
0x77e10000	0x57000	4.00.1381.0335	C:\WINNT\system32\RPCRT4.dll
0x77c40000	0x13c000	4.00.1381.0332	C:\WINNT\system32\SHELL32.dll
0x71700000	0x8a000	5.81.4134.0600	C:\WINNT\system32\COMCTL32.dll
0x77bf0000	0x7000	4.00.1381.0319	C:\WINNT\System32\rpcrtcl1.dll

LOADWC.EXE pid: 225

Command line: "C:\WINNT\System32\loadwc.exe"

Base	Size	Version	Path
0x01000000	0x6000	5.50.4134.0600	C:\WINNT\System32\loadwc.exe
0x77f60000	0x5e000	4.00.1381.0298	C:\WINNT\System32\ntdll.dll
0x77dc0000	0x3f000	4.00.1381.0281	C:\WINNT\system32\ADVAPI32.dll
0x77f00000	0x5e000	4.00.1381.0300	C:\WINNT\system32\KERNEL32.dll
0x77e70000	0x55000	4.00.1381.0310	C:\WINNT\system32\USER32.dll
0x77ed0000	0x2c000	4.00.1381.0298	C:\WINNT\system32\GDI32.dll
0x77e10000	0x57000	4.00.1381.0335	C:\WINNT\system32\RPCRT4.dll
0x70bd0000	0x4c000	5.50.4134.0600	C:\WINNT\system32\SHLWAPI.dll
0x77bf0000	0x7000	4.00.1381.0319	C:\WINNT\System32\rpcrtcl1.dll

sqlmangr.exe pid: 216

Command line: "C:\MSSQL7\Binn\sqlmangr.exe" /n

Base	Size	Version	Path
0x00400000	0x1c000	2000.02.0008.0000	C:\MSSQL7\Binn\sqlmangr.exe
0x77f60000	0x5e000	4.00.1381.0298	C:\WINNT\System32\ntdll.dll
0x77ed0000	0x2c000	4.00.1381.0298	C:\WINNT\system32\GDI32.dll
0x77f00000	0x5e000	4.00.1381.0300	C:\WINNT\system32\KERNEL32.dll
0x77e70000	0x55000	4.00.1381.0310	C:\WINNT\system32\USER32.dll
0x77dc0000	0x3f000	4.00.1381.0281	C:\WINNT\system32\ADVAPI32.dll
0x77e10000	0x57000	4.00.1381.0335	C:\WINNT\system32\RPCRT4.dll
0x78000000	0x40000	6.00.8397.0000	C:\WINNT\system32\MSVCRT.dll
0x71700000	0x8a000	5.81.4134.0600	C:\WINNT\system32\COMCTL32.dll
0x77c40000	0x13c000	4.00.1381.0332	C:\WINNT\system32\SHELL32.dll
0x77b20000	0xb7000	4.00.1381.0326	C:\WINNT\system32\ole32.dll
0x41210000	0x8000	1998.11.0013.0000	C:\MSSQL7\Binn\W95SCM.dll
0x77bf0000	0x7000	4.00.1381.0319	C:\WINNT\System32\rpcrtcl1.dll
0x776b0000	0x14000	4.00.1381.0282	C:\WINNT\system32\WS2_32.dll
0x776a0000	0x7000	4.00.1381.0164	C:\WINNT\system32\WS2HELP.dll

CMD.EXE pid: 209

Command line: "E:\CMD.EXE"

Base	Size	Version	Path
0x01360000	0x42000	4.00.1381.0273	E:\CMD.EXE
0x77f60000	0x5e000	4.00.1381.0298	C:\WINNT\System32\ntdll.dll
0x77e70000	0x55000	4.00.1381.0310	C:\WINNT\system32\USER32.dll
0x77f00000	0x5e000	4.00.1381.0300	C:\WINNT\system32\KERNEL32.dll
0x77ed0000	0x2c000	4.00.1381.0298	C:\WINNT\system32\GDI32.dll

```
0x77dc0000 0x3f000 4.00.1381.0281 C:\WINNT\system32\ADVAPI32.dll
0x77e10000 0x57000 4.00.1381.0335 C:\WINNT\system32\RPCRT4.dll
0x77c40000 0x13c000 4.00.1381.0332 C:\WINNT\system32\SHELL32.dll
0x71700000 0x8a000 5.81.4134.0600 C:\WINNT\system32\COMCTL32.dll
0x77720000 0x11000 4.00.1381.0289 C:\WINNT\system32\MPR.dll
```

listdlls.exe pid: 237

Command line: listdlls

Base	Size	Version	Path
0x00400000	0xe000	2.20.0000.0000	E:\listdlls.exe
0x77f60000	0x5e000	4.00.1381.0298	C:\WINNT\System32\ntdll.dll
0x77f00000	0x5e000	4.00.1381.0300	C:\WINNT\system32\KERNEL32.dll
0x77a90000	0xb000	4.00.1371.0001	C:\WINNT\system32\VERSION.dll
0x77c40000	0x13c000	4.00.1381.0332	C:\WINNT\system32\SHELL32.dll
0x77ed0000	0x2c000	4.00.1381.0298	C:\WINNT\system32\GDI32.dll
0x77e70000	0x55000	4.00.1381.0310	C:\WINNT\system32\USER32.dll
0x77dc0000	0x3f000	4.00.1381.0281	C:\WINNT\system32\ADVAPI32.dll
0x77e10000	0x57000	4.00.1381.0335	C:\WINNT\system32\RPCRT4.dll
0x71700000	0x8a000	5.81.4134.0600	C:\WINNT\system32\COMCTL32.dll
0x779c0000	0x8000	4.00.1371.0001	C:\WINNT\system32\LZ32.dll
0x76ac0000	0x1d000	4.00.1381.0125	C:\WINNT\System32\IMAGEHLP.dll
0x77bf0000	0x7000	4.00.1381.0319	C:\WINNT\System32\rpcrtc1.dll

COMMAND RUN:at

The service has not been started.

COMMAND RUN:sniffer

Sniffer Detector, by H. Carvey (keydet89@yahoo.com)

Packet sniffer not detected.

COMMAND RUN:mdmchk

0 modem(s) detected.

No modem driver entries.

COMMAND RUN:share -s localhost -f

NetShareEnum error: The network path was not found.

COMMAND RUN:ntfsinfo c:

NTFS Information Dump

Copyright (C) 1997 Mark Russinovich

<http://www.ntinternals.com>

Volume Size

Volume size : 3992 MB
Total sectors : 8177084
Total clusters : 1022135
Free clusters : 653574
Free space : 2553 MB (63% of drive)

Allocation Size

Bytes per sector : 512
Bytes per cluster : 4096
Bytes per MFT record : 1024
Clusters per MFT record: 0

Steven G Lukacs
GCFA Practical Assignment

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MFT Information

MFT size : 6 MB (0% of drive)
MFT start cluster : 4
MFT zone clusters : 0 - 127776
MFT zone size : 499 MB (12% of drive)
MFT mirror start : 511067

Meta-Data files

\$MFT 16384 bytes
\$MFTMirr 4096 bytes
\$LogFile 4194304 bytes
\$Volume 0 bytes
\$AttrDef 36000 bytes
\$Bitmap 127768 bytes
\$Boot 8192 bytes
\$BadClus 0 bytes
\$UpCase 131072 bytes
COMMAND RUN:ntfsinfo d:

NTFS Information Dump

Copyright (C) 1997 Mark Russinovich
<http://www.ntinternals.com>

Volume Size

Volume size : 13327 MB
Total sectors : 27294434
Total clusters : 3411804
Free clusters : 2768471
Free space : 10814 MB (81% of drive)

Allocation Size

Bytes per sector : 512
Bytes per cluster : 4096
Bytes per MFT record : 1024
Clusters per MFT record: 0

MFT Information

MFT size : 6 MB (0% of drive)
MFT start cluster : 4
MFT zone clusters : 0 - 426496
MFT zone size : 1666 MB (12% of drive)
MFT mirror start : 1705902

Meta-Data files

\$MFT 16384 bytes
\$MFTMirr 4096 bytes
\$LogFile 4194304 bytes
\$Volume 0 bytes
\$AttrDef 36000 bytes

```
$Bitmap      426480 bytes
$Boot        8192 bytes
$BadClus     0 bytes
$UpCase      131072 bytes
COMMAND RUN:rasautou -s
COMMAND RUN:date /t
Sun 10/27/2002
COMMAND RUN:time /t
9:29p
```

Live Online Analysis – Windows Forensics Tools continued...

Commands with abnormal output

- **netstat -an** is used to display network connections and provided a multitude of information regarding the active connections on the system. In the output of netstat we see 100 active connections to varying IP addresses on destination port 1433 (mssql). The SQL worm is scanning for other systems running MSSQL 7 with blank administrator passwords.
- **pslist and ps -ealW** also provided some interesting facts. There are two copies of the services.exe program running. One is at PGID 48 and the other is at PGID 136. We know from the SQL Worm analysis that services.exe (fscan) is copied to C:\WINNT\System32\Drivers and this corresponds with our process at PGID 136. We also know from our netstat output that the system is actively scanning systems on port 1433 as described in the SQL worm analysis, thus we are sure that PGID 136 is in fact fscan, a command the worm used to portscan other systems.
- **psinfo** is used to take a snapshot of a number of system items including the kernel version, product type, product version, service pack, kernel build number, organization, owner, install date, system root folder, number of processors, processor speed and type, physical memory and applied hotfixes. The information output in this case was normal and confirmed the known configuration, however the applied hotfix listing showed this system was out of date.
- **listdlls** displays a list of running applications and their associated dynamic link libraries. Proof that the worm is active can be seen in the output of **listdlls**. We see the two services commands PGID 48 and 136. The first looks normal, the second has the following syntax →
C:\WINNT\system32\drivers\services.exe" -q -c 10000 10.1.1.1-255.254 -p 1433 -o rdata.txt -z 100. Obviously the worm is at work actively scanning other systems. Also seen by **listdlls** is the sqlprocess.js script, which is the worms main script that activates the commands such as services.exe (fscan) and others as described in the worm analysis.

- **share** displays the shares available on the system via a. The victim system had multiple shares available that could be accessed and exploited, however no evidence was found to confirm this theory.

Commands with normal output

- **time /t** and **date /t** are commands used to display and record the system time and date at the time of the online analysis.
- **fport** did not produce any output due to an incompatibility with the victim system.
- **nbtstat -c**
- **arp -a** is a command used to display the MAC addresses of systems or devices that have recently connected to the host system. In this case, the victim system was connected to a closed test network and did not provide any information to be used in the analysis.
- **route print** is used to show the system routes or paths that need to be taken by default or specific networks. The output of this shows normal routing for the configured networks.
- **net file, session, share, start, use, view** are all commands used to display information about network shares. Although configuring shares is not a good security practice, there was no evidence the shares were used or accessed.
- **uname -a** is a command used to display the system hostname, hardware type, operating system release, operating system name, processor type and version. For this purpose we use it for confirmation.
- **uptime** is used to show how long the system has been running. This is useful in a live analysis to show if the system had been recently re-booted, due to the installation of a component such as a sniffer driver or some hostile attack that would initiate a re-boot. In this case, the system was booted in a controlled manner and the output of uptime was not useful.
- **hostname** is used to show the assigned name of the system.
- **whoami** shows the current logged in user. In this case it was the admin user. An investigator can use this command to ensure they have the appropriate access rights to run many of the forensics commands required for analysis.
- **env** is a command used to display the system environment variables. All of the variables displayed appeared normal.
- **psloggedon** shows the current users logged onto the system.
- **ntlast -r -f** shows that last few users who accessed the system including login times and dates. This output appeared normal.
- **at** The at command is the Windows equivalent to the Unix crontab command. It is used to schedule automated tasks. The victim system did not have any scheduled jobs.
- **sniffer** is used to check for packet capturing applications or drivers. None were detected on the victim system.

- **mdmchk** is used to check for modem drivers. None were detected on the victim system.
- **ntfsinfo** is used to display an overview of the volume information on the system including meta data, layout and percentage of volume used. Output was normal and gave an understanding of how much disk was used and would have to be recovered for analysis.
- **rasautou -s** shows the use of dialup networking. No dial up network was configured on this system.
- **sfind** was run on a Windows 2000 system with the victim system mounted as a secondary disk. No alternate data stream files were located in both victim partitions C: and D:
- **time /t** and **date /t** are commands used to display and record the system time and date at the time of the online analysis. In this case it is used to document the end time of the forensics commands run via the batch file.

MAC Time Analysis

The screen shots below identify the original build date as Jan 9, 2001 @ 23:48:04 PST, as can be seen by the MFT creation and the MFT mirror creation. However it seems this may be inaccurate since it seems unlikely someone was building the system at that time in the evening. Further analysis shows the time changing mid-install which may identify that the Windows system installer modified the system time to the current time zone during the installation. Last access to the system was June 4, 2002 @ 23:52:53 when it was logged into by an ACME Corp administrator to verify the system identity before decommissioning. *Note: The project managers and the forensics investigator were not aware of the ACME administrator who maintained a copy of the administrator as described in the first section of this analysis.* The system was powered off by the power switch and not shutdown by normal operating system methods. See Images 9.0-9.1

Image 9.0

Time	File Name	Size	Type	Path
Tue Jun 26 2007 23:49:09	0000	0	dir	\\-Autopsy 45 0 1-129-1 C:\BPF\
	131072	0	dir	\\-Autopsy 45 0 9-129-1 C:\BPF\
	0	0	dir	\\-Autopsy 45 0 3-129-1 C:\BPF\
	418884800	0	dir	\\-Autopsy 45 0 8-129-1 C:\BPF\
	0	0	dir	\\-Autopsy 45 0 5-129-1 C:\BPF\
	4096	0	dir	\\-Autopsy 45 0 1-129-1 C:\BPF\
	0	0	dir	\\-Autopsy 45 0 3-129-1 C:\BPF\
	127780	0	dir	\\-Autopsy 45 0 6-129-1 C:\BPF\
	9180	0	dir	\\-Autopsy 45 0 1-129-1 C:\BPF\
	128302	0	dir	\\-Autopsy 45 0 10-129-1 C:\BPF\
	610034	0	dir	\\-Autopsy 45 0 8-129-1 C:\BPF\
	419024	0	dir	\\-Autopsy 45 0 2-129-1 C:\BPF\
	30000	0	dir	\\-Autopsy 45 0 4-129-1 C:\BPF\
Tue Jun 26 2007 23:50:01	22018	0	dir	\\-Autopsy 45 0 121-129-4 C:\BPF\
	78820	0	dir	\\-Autopsy 45 0 125-129-4 C:\BPF\
	71802	0	dir	\\-Autopsy 45 0 124-129-4 C:\BPF\
Tue Jun 26 2007 23:50:02	6488	0	dir	\\-Autopsy 45 0 140-129-4 C:\BPF\
Tue Jun 26 2007 23:50:03	38072	0	dir	\\-Autopsy 45 0 140-129-4 C:\BPF\
	62401	0	dir	\\-Autopsy 45 0 140-129-4 C:\BPF\
	10776	0	dir	\\-Autopsy 45 0 140-129-4 C:\BPF\
	62401	0	dir	\\-Autopsy 45 0 140-129-4 C:\BPF\
	3023	0	dir	\\-Autopsy 45 0 140-129-4 C:\BPF\
Tue Jun 26 2007 23:50:04	27020	0	dir	\\-Autopsy 45 0 140-129-4 C:\BPF\
Tue Jun 26 2007 23:50:05	9717	0	dir	\\-Autopsy 45 0 140-129-4 C:\BPF\
Tue Jun 26 2007 23:50:06	52877	0	dir	\\-Autopsy 45 0 140-129-4 C:\BPF\
	68880	0	dir	\\-Autopsy 45 0 140-129-4 C:\BPF\
	38802	0	dir	\\-Autopsy 45 0 140-129-4 C:\BPF\
	2784	0	dir	\\-Autopsy 45 0 140-129-4 C:\BPF\
Tue Jun 26 2007 23:50:07	28420	0	dir	\\-Autopsy 45 0 141-129-4 C:\BPF\
	8191	0	dir	\\-Autopsy 45 0 141-129-4 C:\BPF\
	8191	0	dir	\\-Autopsy 45 0 141-129-4 C:\BPF\
	8226	0	dir	\\-Autopsy 45 0 141-129-4 C:\BPF\

Image 9.1

Time	File Name	Size	Type	Path
	228132	0	dir	\\-Autopsy 45 0 3072-129-4 C:\BPF\
	22280	0	dir	\\-Autopsy 45 0 3085-129-4 C:\BPF\
	228132	0	dir	\\-Autopsy 45 0 3072-129-4 C:\BPF\
	271358	0	dir	\\-Autopsy 45 0 258-129-4 C:\BPF\
	40960	0	dir	\\-Autopsy 45 0 479-129-4 C:\BPF\
	32316	0	dir	\\-Autopsy 45 0 2876-129-4 C:\BPF\
	77802	0	dir	\\-Autopsy 45 0 3085-129-4 C:\BPF\
Tue Jun 26 2007 14:50:11	800	0	dir	\\-Autopsy 45 0 4095-144-1 D:\BPF\
	628	0	dir	\\-Autopsy 45 0 4095-144-1 D:\BPF\
	628	0	dir	\\-Autopsy 45 0 4095-144-1 D:\BPF\
	628	0	dir	\\-Autopsy 45 0 4095-144-1 D:\BPF\
Tue Jun 26 2007 14:50:19	25380	0	dir	\\-Autopsy 45 0 1805-129-4 C:\BPF\
	19328	0	dir	\\-Autopsy 45 0 1783-129-4 C:\BPF\
	19328	0	dir	\\-Autopsy 45 0 2214-129-4 C:\BPF\
	19328	0	dir	\\-Autopsy 45 0 2214-129-4 C:\BPF\
Tue Jun 26 2007 14:50:21	19328	0	dir	\\-Autopsy 45 0 2214-129-4 C:\BPF\
Tue Jun 26 2007 14:50:26	30123794	0	dir	\\-Autopsy 45 0 3086-129-4 C:\BPF\
Tue Jun 26 2007 14:50:33	212980	0	dir	\\-Autopsy 45 0 3187-129-4 C:\BPF\
	1024	0	dir	\\-Autopsy 45 0 3186-129-4 C:\BPF\
Tue Jun 26 2007 14:50:51	70442	0	dir	\\-Autopsy 45 0 1017-129-4 C:\BPF\
Tue Jun 26 2007 23:52:51	24846	0	dir	\\-Autopsy 45 0 1495-129-4 C:\BPF\
	24876	0	dir	\\-Autopsy 45 0 1493-129-4 C:\BPF\
	96504	0	dir	\\-Autopsy 45 0 1493-129-4 C:\BPF\
	24846	0	dir	\\-Autopsy 45 0 1495-129-4 C:\BPF\
	19328	0	dir	\\-Autopsy 45 0 1497-129-4 C:\BPF\
	24876	0	dir	\\-Autopsy 45 0 1497-129-4 C:\BPF\
	61780	0	dir	\\-Autopsy 45 0 1494-129-4 C:\BPF\
	38880	0	dir	\\-Autopsy 45 0 1786-129-4 C:\BPF\
	24876	0	dir	\\-Autopsy 45 0 1493-129-4 C:\BPF\
	19328	0	dir	\\-Autopsy 45 0 1497-129-4 C:\BPF\
	32780	0	dir	\\-Autopsy 45 0 1494-129-4 C:\BPF\
Tue Jun 26 2007 23:53:53	5897	0	dir	\\-Autopsy 45 0 194-129-4 C:\BPF\

To perform an offline analysis, TASK 1.52 and Autopsy 1.62 were used to capture activity timelines from sdb2.dd →(C: drive) and sdb3.dd →(D: drive). Before we went any further however, an image integrity check was required to ensure the data being analyzed was an exact bit image of the original. We then began the initial file activity analysis. The first step is to create the body file, which holds and combines all of the timestamp information for both images. We use this file as a raw feed for selecting timelines in which to make our analysis. See Images 10.0-10.1

Image 10.0

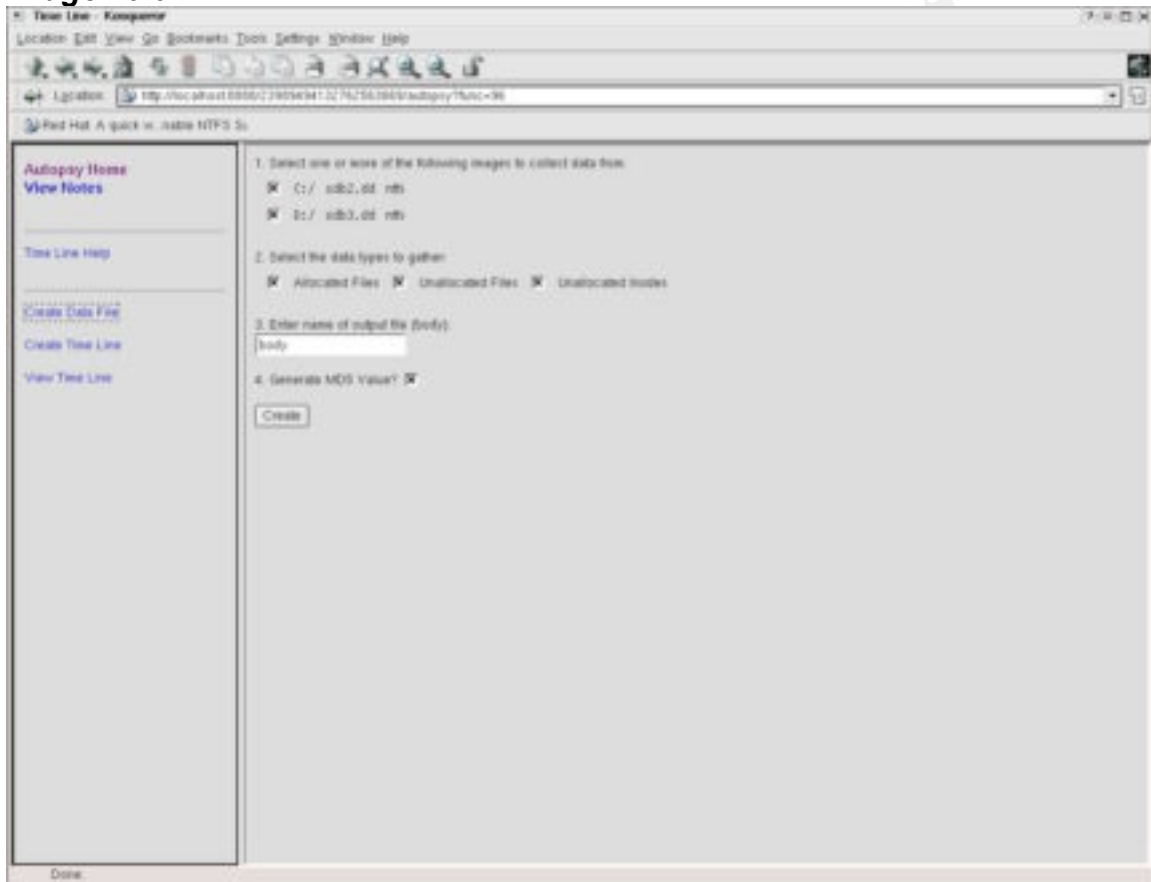
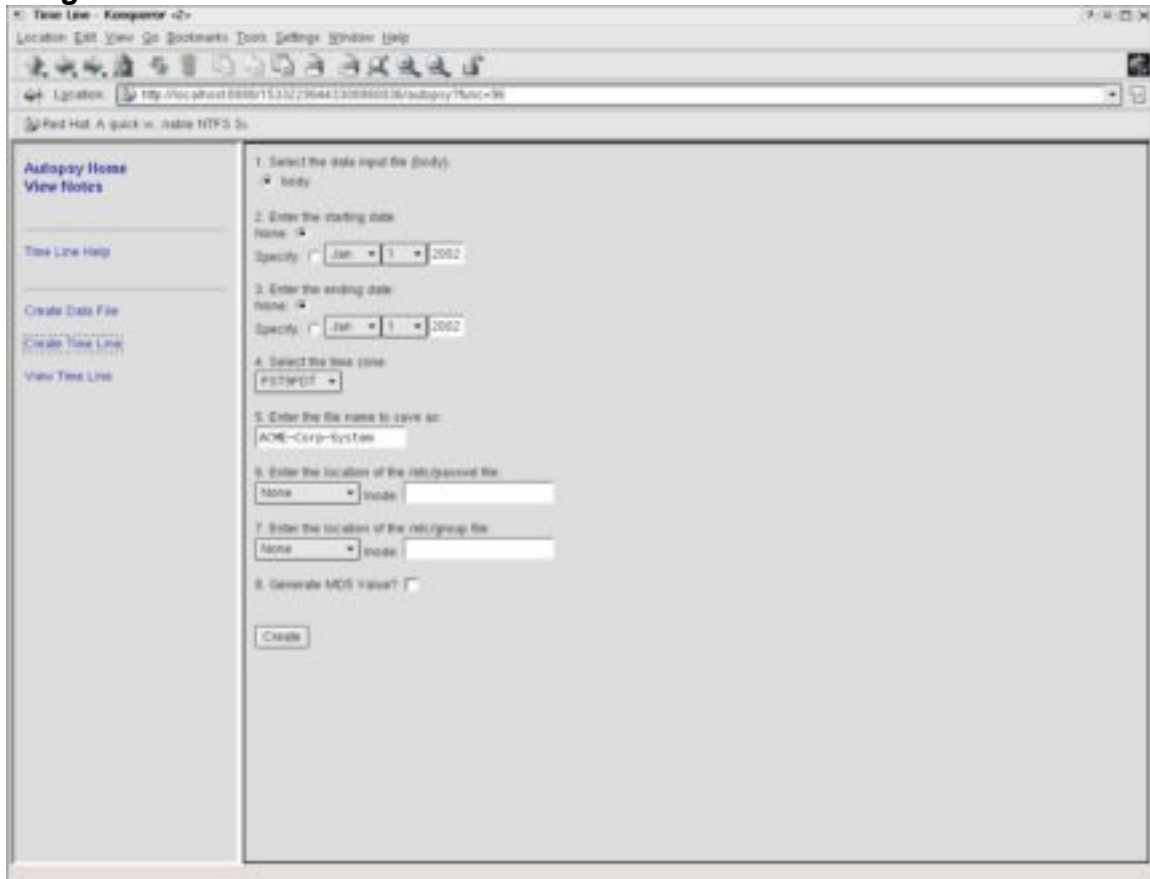


Image 10.1

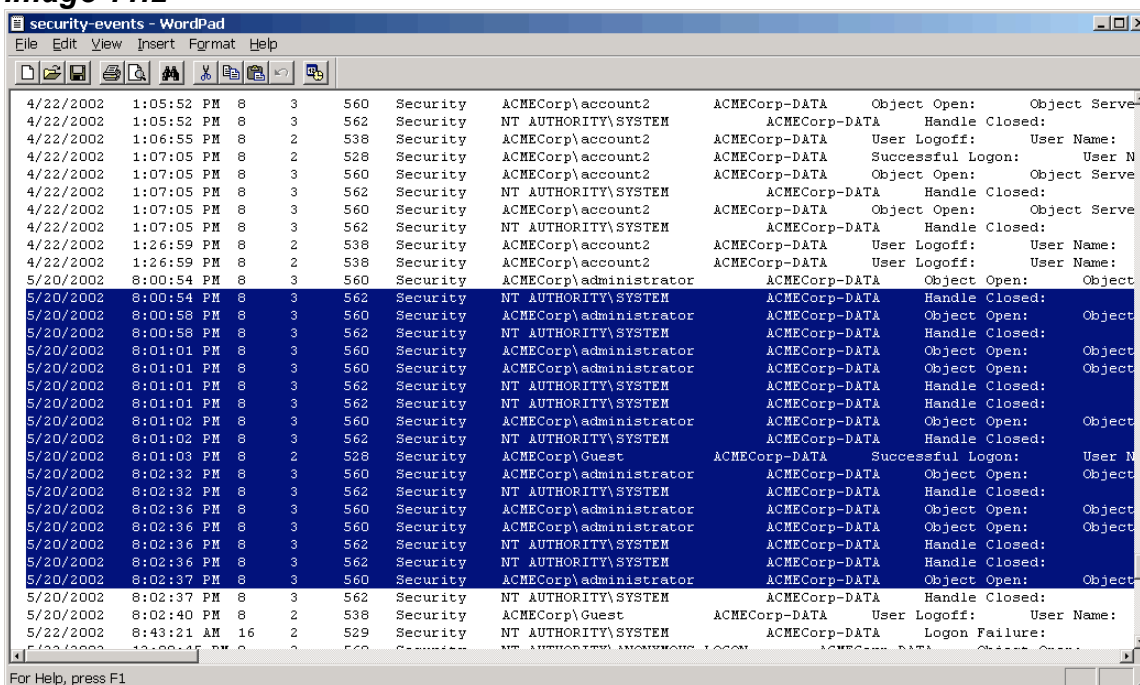


We need to know some information about the incident so we can narrow down the timelines to select for analysis. In this case we know the incident happened in the May 2002 timeframe so this seems like a good place to begin.

In most cases it is a good idea to make the analysis timeline long enough to identify the actual compromise time. In other words, you may notice the effects of the compromise long after the actual incident began. I started my analysis at Jan 1, 2002 since our initial incident date was May 22, 2002. This gives us enough flexibility to take a look back to confirm the system was operating normally prior to the incident.

Once I reached the May 2002 timeframe, which was when the initial incident was reported I immediately identified the first files that appeared on the Autopsy forensic browser as those of the SQL Snake. The tell tale java script files, and corresponding access of system files matched the analysis done by SANS at www.incident.org^{iv} and Symantec at <http://securityresponse.symantec.com/avcenter/venc/data/js.spida.b.html>^v

Image 11.2



Once the worm's files were transferred to the victim system, two additional steps took place. The first is the gathering of network, system and password information that is emailed to an account called ixltd@postone.com. These steps can be seen in image 11.0 where we see ipconfig.exe (Network Information), sqldir.js (MSSQL Database information), and pwdump2.exe (Password Information) accessed and utilized to gather the information emailed via clemail.exe, which is also seen in image 11.0. The mailing step is seen with the access of clemail.exe at 10:05:42pm. We can also identify modifications which are made to the system registry with the access of regedit32.exe @ 20:02:40. These registry changes are made to enable the SQL server to use the Winsock library instead of the DBNETLIB library. Additionally, it activates the NetDDE service, allowing the SQL server to be accessed through the DDE protocol.^{vi} See image 12.0 -- live analysis registry dump below.

the timeline analysis. Since these files are identical in size and were modified at the same time, I conclude they are the same file. Because this is an Internet Explorer temp file, we know it was used as a temporary placeholder while downloading and then saved in the given location once the download was complete. To verify this, the file is undeleted using Autopsy 1.6.2 and viewed with a text editor in order to verify the contents of the file. In the output below we see the file (pntr[1].htm) is in dark red, which is described in the Autopsy help as a deleted file in which this inode has been deleted but the reallocated data may not accurate (See image 13.0). However it is still worth taking a look to see if any information can be gleaned from this to help determine how the system was compromised.

Image 13.0

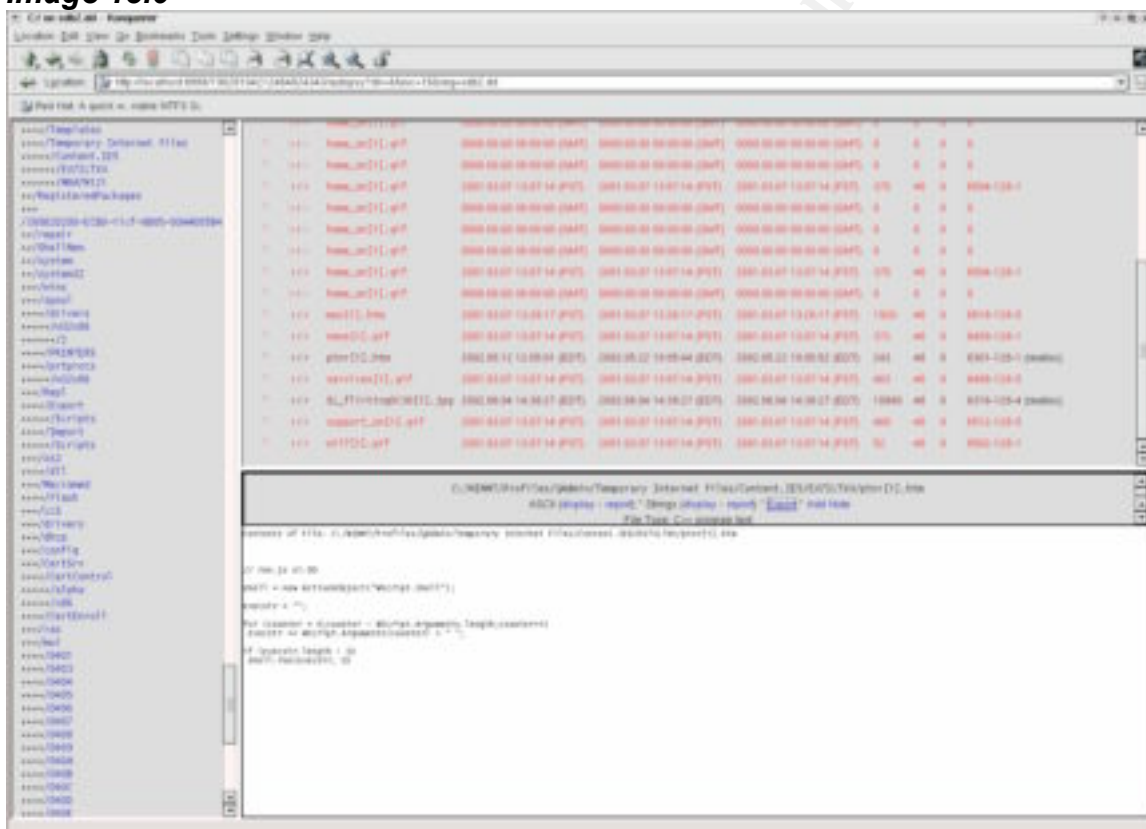


Image 13.1

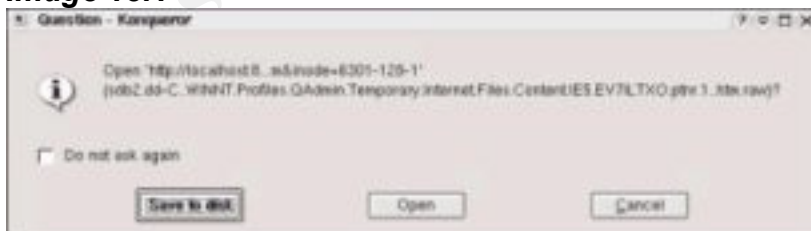
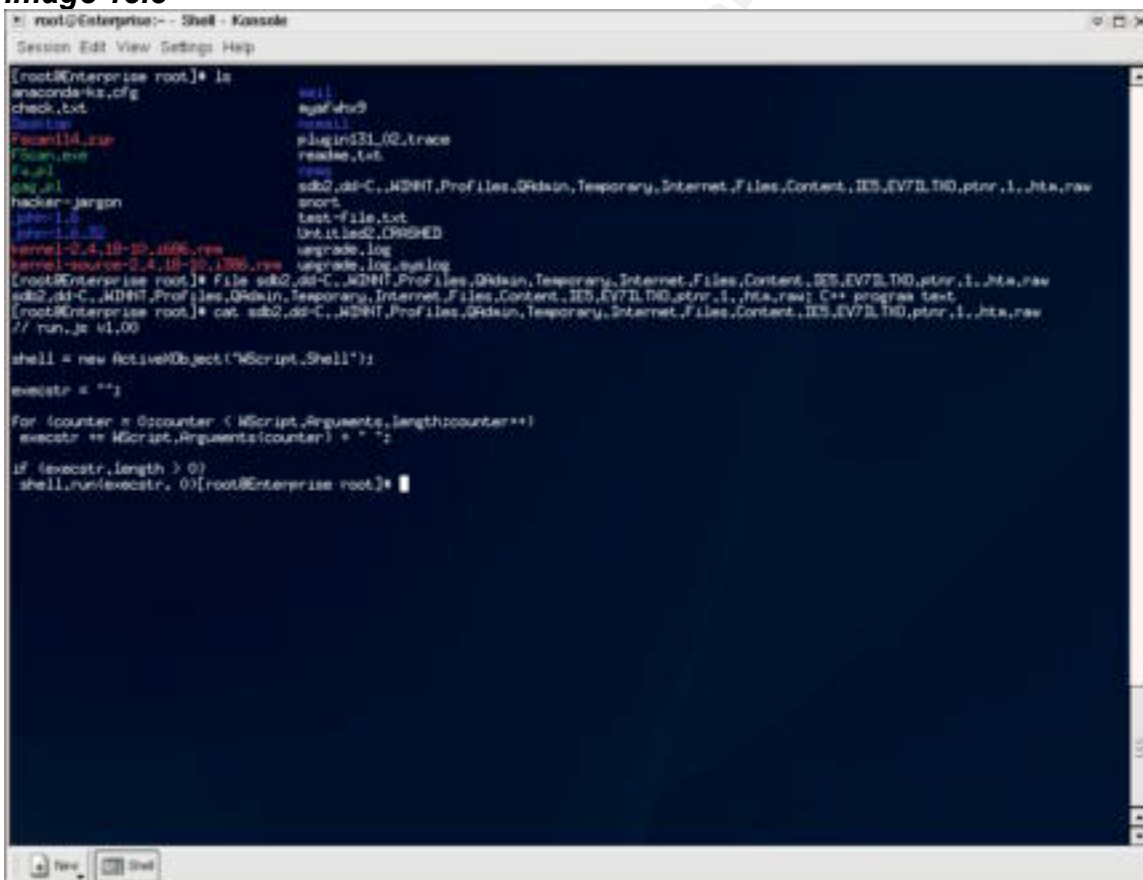


Image 13.2



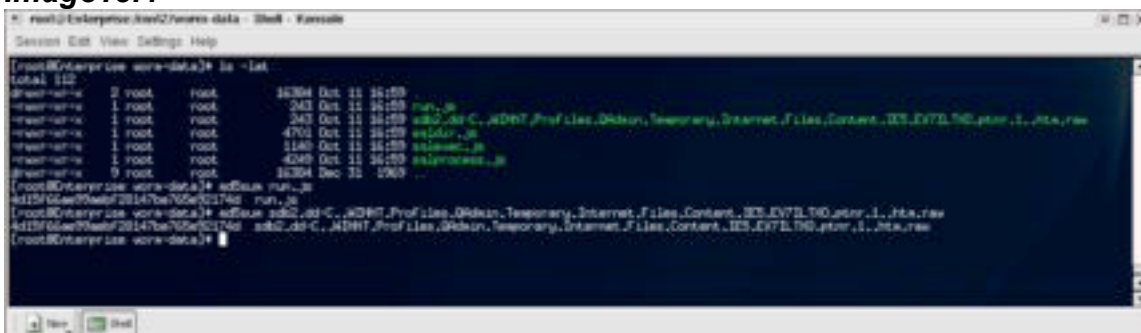
Image 13.3



In images 13.0-13.3, the file has been successfully restored and saved to disk. The "file" command is then used to verify the file type, which in this case is program text. The next step is to view the file contents, attempting to ascertain the purpose. The file is java script and appears to be the same as run.js. To

conclusively verify the files are the same, an MD5 checksum was run against both files as seen in image 13.4.

Image13.4



In order to ascertain which files belong to the SQLSnake, I located a known SQL worm file and then used Autopsy to sort by inode. This provided a sequential view of the inodes for the timeframe when the first known worm files appeared and helped to identify other SQL worm files. Typically worms or viruses are automated and the files are copied or unzipped from an archive and appear sequentially. In image 14.0 we can see the inodes begin at 6295 and continue into the 6300s'. This information was used to identify which files were part of the SQL worm and used to restore them for analysis. There were 5 files that made up the actual worm itself with 5 supporting files used to gather information for the worm. The worm's files that were recovered were java script files and a batch file. Extensive analysis on the worm was not required since information and detail analysis was available at a number of security sites.

was reviewed by project managers and confirmed as original. However, timeline analysis of user logins and file system activity confirmed an outsider had not accessed the system after the worm's infection.

The SQL Worm was not destructive to the core system data, however system confidentiality, integrity and availability were compromised.

- **Confidentiality:** The Worm collected and transmitted confidential information to an email account in Singapore.
- **Integrity:** The Worm modified system accounts and replaced and deleted files.
- **Availability:** The Worm used the database server to scan other Internet systems for the MSSQL vulnerability. Scanning was intense and may have at times caused system performance degradation.

Interviews with the original ACME Corporation's project managers revealed the initial project did not include security measures such as firewalls, security patches, vulnerability assessments, threat risk assessments, or even basic security such as assigning strong passwords.

Implications resulting from this compromise include potential liabilities incurred from the system attacking and infecting other systems, customer confidence, ACME Corporation's image and integrity and the potential disclosure of privacy information.

Assignment 2 - Analysis of an Unknown Binary

Binary Details

File name - "sn.dat" → See Image 20.0

File Details - ELF 32-bit LSB executable, Intel 80386, version 1 (SYSV), statically linked, stripped.

File size - 399,124 bytes

MD5 checksum - 0e954f43fd73f56e812a7285f32e41d3

File and Group owners - root

Image 20.0

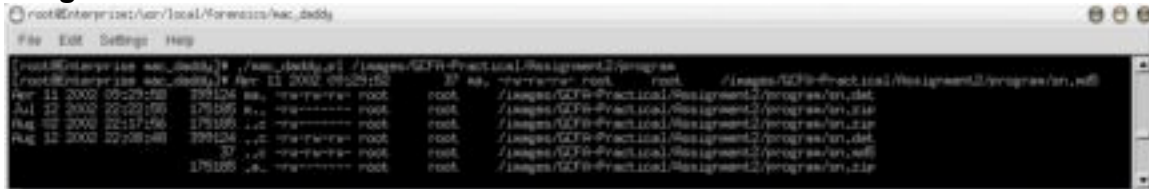


```
root@Enterprise:~/workspace/GCFA-Practical/Assignment2/program# ls -lat
total 396
drwxr-xr-x  2 root  root   4096 Aug 12 22:08 .
drwxr-xr-x  7 root  root   4096 Aug  5 22:26 ..
-rwxr-xr-x  1 root  root  171168 Jul 13 21:29 sn.dat
-rwxr-xr-x  1 root  root  399124 Aug 11 21:29 sn.dat
-rwxr-xr-x  1 root  root    37488 Aug 11 21:29 sn.dat
root@Enterprise:~/workspace/GCFA-Practical/Assignment2/program# md5sum *
0e954f43fd73f56e812a7285f32e41d3  sn.dat
0e954f43fd73f56e812a7285f32e41d3  sn.dat
0e954f43fd73f56e812a7285f32e41d3  sn.dat
root@Enterprise:~/workspace/GCFA-Practical/Assignment2/program#
```

Modify/Access/Change times: → See Image 20.1

Last used: April 11, 2002 – 09:29:58 CST
Last accessed: April 11, 2002 – 09:29:58 CST
Last changed: August 12, 2002 – 22:08:48 CST

Image 20.1



Unzip with the `-X` option was used to decompress the archive which preserves the UID and GID. In this case they were the root user.

Program Description

“sn.dat” is a network sniffer which, is used to log packets traversing across a network interface card in normal or promiscuous mode.

Once the program was unzipped from its archive, the use of the “file” command identified the file type, platform of use, and whether it called system libraries to complete execution. With this particular build of ADMsniff it appeared to be statically linked (libraries were included within the program and did not use shared system libraries) and stripped (no debugging symbols). Programs are generally compiled with debugging symbols to help make the task of troubleshooting easier by providing output readable by debugging programs such as gdb.

Applications & commands used in Forensic analysis:

1. file
2. ldd
3. strings -a
4. objdump
5. nm
6. readelf
7. gdb
8. hexdump
9. ald
10. strace
11. ltrace
12. truss -vlistat -tlistat ls -l “filename”
13. Unzip -X

Step-by-Step analysis of “sn.dat”

The file "sn.zip" was uncompressed using `unzip -X` which, preserves the file attributes helping to ensure the forensics analysis is not tainted. Once decompressed, the archive produced 2 files – "sn.dat" and "sn.md5".

The next step of the process was to view the MAC (modify, access and creation) times of the file to determine when it was created, modified and accessed. The sequence of this step is important in providing accuracy because some of the Unix commands used in this analysis such as the `file` command will change the access time, thus providing erroneous results and corrupting the evidence we are attempting to gather. There are multiple ways to determine the MAC times of a file depending on the operating system in question. As part of the Coroners Toolkit, the application "mac daddy" can be used to gather Modify, Access and Create times for most Unix platforms including Linux, Solaris, BSD and so on. In Solaris the command "truss" can be used to gather MAC times. Specifically, `truss -vlsat -tlstat ls -l "file or directory name"`.^{vii}

To determine the type of file in question, Unix provides a command called "file" which analyses the first 1024 bytes of a file and compares that header information to known headers in `/etc/magic`. This command is valuable in that no program execution takes place, potentially causing undesired results or damage to your system. Using the "file" command on "sn.md5" and "sn.dat" revealed 2 types of files. The first file -- "sn.md5" is a text file containing the alleged, 32-bit md5 cryptographic checksum of the file "sn.dat". The other file, sn.dat is a 32-bit ELF binary. The analysis now focuses on the binary since the text file contained no other forensic evidence of value. The binary file "sn.dat" was both statically linked and stripped which meant the file was autonomous, requiring no shared libraries for successful execution and provided no symbols which could be used to help determine what kind of program this was and how it executed.

Next, we want to validate the structure of the file. The `readelf` command is used to display information about ELF format object files and is valuable for identifying file structure problems such as abnormal entry points or sections of a file that don't make sense (sizes are out of place). The output received from "sn.dat" displayed a normal entry point, showing the application is a typical executable that should be viewable by typical forensics tools such as `gdb`, `file`, `lsolf`, and `strings`.

In some cases black hats will modify the entry point (The typical area the program begins) to disguise what type of program and what can be seen with basic forensics techniques. Typical entry points for ELF binaries start with `0x804` while other entry points can be treated as suspicious and warrant further investigation. See image 21.0

Image 21.0

```
root@Enterprise:~/gcfa-Practical/Assignment2/program
File Edit Settings Help
[root@Enterprise program]# readelf -s a.out
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 386
  Version: 0x1
  Entry point address: 0x00400a0
  Start of program headers: 52 (bytes into file)
  Start of section headers: 39036 (bytes into file)
  Flags:   0x0
  Size of this header:   52 (bytes)
  Size of program headers: 52 (bytes)
  Number of program headers: 5
  Size of section headers: 40 (bytes)
  Number of section headers: 19
  Section header string table index: 15

Section Headers:
 [Nr] Name              Type             Addr      Off      Size   ES Flg Lk InDf Al
  [0] [Name]              Type             Addr      Off      Size   ES Flg Lk InDf Al
  [1] .init               PROGBITS         00004004 000004 000018 00 00 0 0 4
  [2] .init.              PROGBITS         00004000 000000 000004 00 00 0 0 32
  [3] .fini               PROGBITS         00004000 000100 000004 00 00 0 0 4
  [4] .shdata             PROGBITS         00004000 000100 010000 00 00 0 0 4
  [5] __libc_start        PROGBITS         00004000 05a800 000004 00 00 0 0 4
  [6] __libc_freeres      PROGBITS         00004004 05a804 000040 00 00 0 0 4
  [7] __libc_subinit      PROGBITS         00004004 05a804 000008 00 00 0 0 4
  [8] .data               PROGBITS         00004000 05a800 001260 00 00 0 0 32
  [9] __eh_frame          PROGBITS         00004000 05c000 000004 00 00 0 0 4
  [10] .ctors              PROGBITS         00004004 05c004 000008 00 00 0 0 4
  [11] .dtors              PROGBITS         0000400c 05c00c 000008 00 00 0 0 4
  [12] .got                PROGBITS         00004004 05c004 000010 04 00 0 0 4
  [13] .tbss               PROGBITS         00004004 05c0c0 000000 00 00 0 0 1
  [14] .bss                PROGBITS         00004000 05c0c0 0005a0 00 00 0 0 32
  [15] .comment            PROGBITS         00000000 05c0c0 000008 00 00 0 0 1
  [16] .note.ABI-tag       NOTE             00004004 000004 000020 00 00 0 0 4
  [17] .note                NOTE             00000000 000000 001264 00 00 0 0 1
  [18] .shstrtab           STRTAB           00000000 061264 0000af 00 00 0 1

Key to Flags:
 H (hash), R (relax), W (compress), 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          FileSize          MemSize          Flg Align
LOAD           0x00000000      0x00000000        0x00400000        0x5a0c             0x5a0c           R L  0x1000
LOAD           0x00000000      0x00000000        0x00000000        0x0100             0x0100           R  0x1000
NOTE          0x00000004      0x00000004        0x00400004        0x0000             0x0000           R  0x4

Section to Segment mapping:
Segment Sections...
00  .init .text .fini .shdata __libc_start __libc_freeres __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.
[root@Enterprise program]#
```

The next step of the analysis process is to go beyond the meta-data of the file and dig into the program itself, hopefully revealing some important clues as to the nature and intent of the program. One of the most common tools used on Unix platforms -- and a very valuable tool for forensics use is the command "strings".

Strings is used to display printable characters embedded in any file that are 4 characters or longer. Output of the strings command identified some interesting information. See Image 22.0

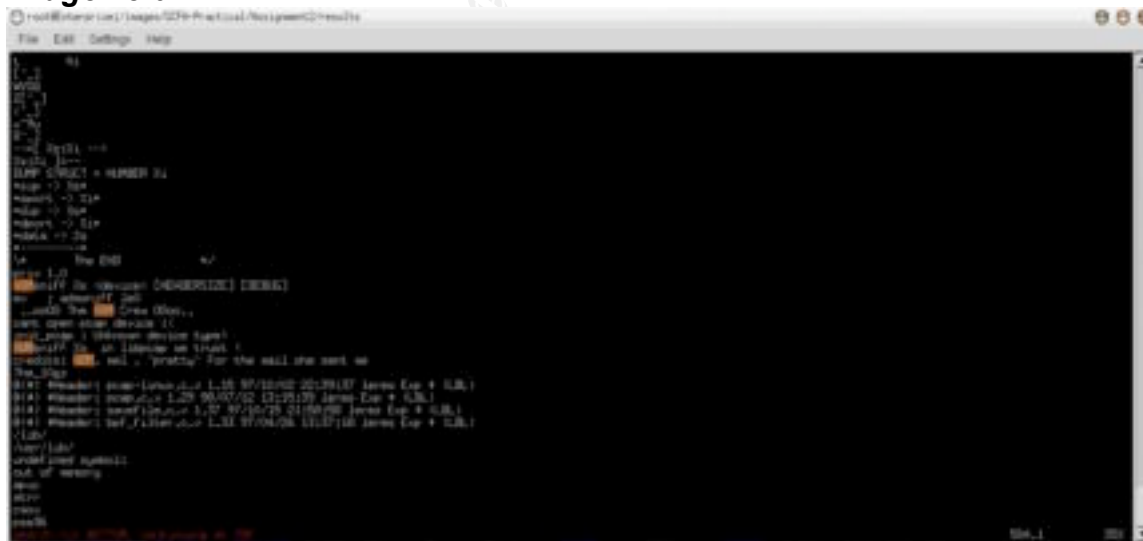
domain as the Web Site of Keld Simonsen. Keld has a project, ISO/IEC 15897, which, is approved as an international standard. In addition, Keld has authored RFC1345, another standard for character set internationalization. <http://asg.web.cmu.edu/rfc/rfc1345.html>.

Registration procedures for cultural elements (ISO/IEC 15897)

Title:	Registration procedures for cultural elements
Project number:	JTC1.22.15897
Standard type:	An International Standard for registry procedure and an International Registry
Project editor:	Keld Simonsen
Current draft:	N849
first draft was:	N610
Status:	Approved as international standard. A revision is begun, and was sent out for CD ballot July 2001.

Due diligence in investigating this piece of the binary shows that Keld is not the author of this program, only that this program is using some of his work. See Image 23.0

Image 23.0



Further up in the code of this program reveals some interesting text. Specifically, the following strings:

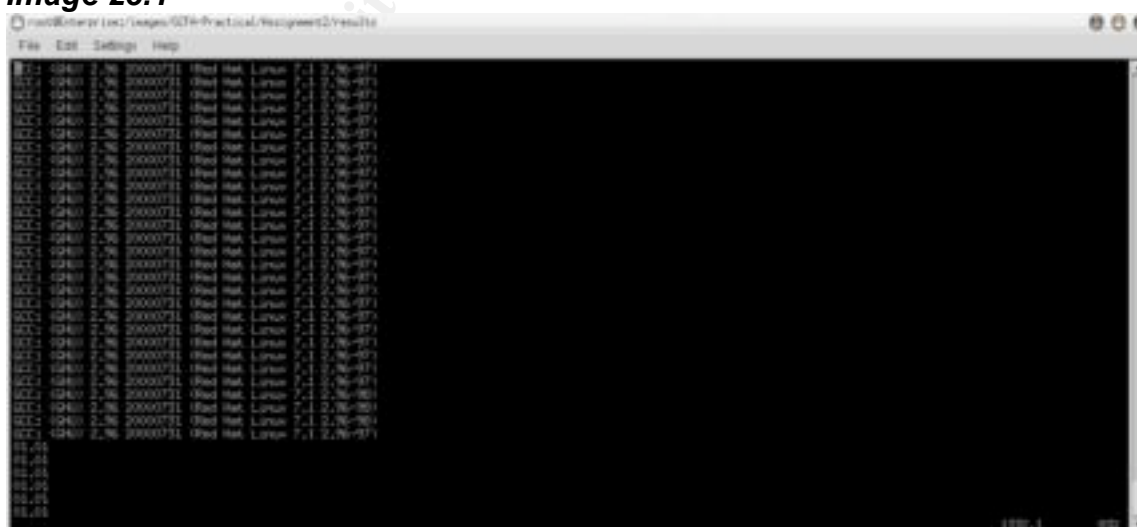
- ADMsniff
- le0

- ..oo00 The ADM Crew 00oo..
- ADMsniff %s in libpcap we trust!
- Credits: ADM, mel, ^pretty^ for the mail she sent me
- The_l0gz
- cant open pcap device :<
- *sip → %s*
- *sport → %i*
- *dip → %s*
- *dport → %i*
- *data → %s*

All of these strings warrant investigation due their contextual nature. For example, the lines "ADMSniff %s in libpcap we trust!" and "Credits: ADM, mel, ^pretty^ for the mail she sent me" is not something that would be found in a typical programs. These entries appear to be more juvenile in nature and may indicate a hacking mentality. In addition, we will see in the future analysis of the application that the string "The_l0gz" reveals significant information into the workings of the program, not something typically done in a professionally coded application. We will also see "sip, sport, dip, dport and data" revealing more important information into the motive for this application.

Beyond the profiling aspect of this analysis, we see strings output such as "pcap", "libpcap" and "le0" in multiple areas. The string "libpcap" refers to a library used to capture packets on a system connected to a network. The string "le0" is the default network device on X86 based Linux systems. These are some very strong clues suggesting we are dealing with a packet capturing application. The specific function and reason for this application is unknown at this point however, with further investigation we should reveal it's purpose. See Image 23.1

Image 23.1



In image 23.1 we see strings output showing specific versions of GCC and Red Hat Linux 7.1 2.96-97. This information suggests that the program was compiled

fairly recently since Red Hat 7.1 was released in early 2001. Although not extremely important information it does provide a frame of reference.

Applications & Commands not used:

ldd – Typical binary files that require dynamically linked system libraries will provide valuable insight on what the program does by the libraries it uses. When **ldd** is run against a file it will enumerate the libraries required to successfully execute and run the program. Since **sn.dat** is not dynamically linked, **ldd** will not provide us with any information other than the file is statically linked. If the file **sn.dat** used system libraries, we would discover that one of the libraries was related to a packet capture library and would have provided more evidence on the use of this application.

Forensic Details

“**sn.dat**” is actually a well known network sniffer called **ADMSNIFF** which is specifically used to log traffic and commands of well-known services that systems administrators or users use to access systems.

The data **ADMSniff** captures is specific to connections made by applications on the following ports → **telnet**(Port 23), **ftp**(Port 21),**shell**(Port 514), **rlogin**(Port 513), **rexec**(Port 512), **imap**(Port 143), **pop**(Port 110), **pop2**(Port 109), and **Back Orifice**(Port 31337).

When a user logs into the host running **ADMSniff** using one of the above services/ports, **ADMSniff** will log the network connection and keystrokes the user types. Logs are saved to a log file call “**The_I0gz**” and contain detailed information on all the data captured over the network to the ports listed above.

The following is information collected in the log file:

- Date & Time of communication
- Source Port
- Destination Port
- Source IP
- Destination IP
- Data – All keystrokes.

The parts of the file system affected by the execution of this application include **/proc** which represents the application on disk as it is in memory. In addition, the application creates a log file called “**The_I0gz**”, which is used by the application to record the incoming data. If the application “**sn.dat**” were not statically compiled then more areas of the file system would be affected such as system libraries.

Multiple clues become evident after analysis of the application using the output from strings. There are numerous instances referencing the hacking group “**ADM**”

Crew” who have a high visibility on the internet and are alleged-ldly responsible for hacking into Web Sites such as Def Con - <http://news.com.com/2100-1023-228253.html?legacy=cnet>,^{ix} attempting to exploit system vulnerabilities such as NFS - <http://www.geocrawler.com/archives/3/199/1999/1/0/1348550/>^x and posted articles on their own Web Site for DNS ID hacking - <http://adm.freelsd.net/ADM/ADMID.txt>^{xi}.

The link pointing to the possible NFS exploit above which, references the ADM Crew in the syslog output of the destination machine has a source IP that resides in Germany and may be where the ADM Crew is located. Of course it is always likely that hackers of this caliber will hide their tracks and/or use other systems they have already compromised as jump points to exploit other systems.

The ADM Crew’s Web Site is listed in RIPE as belonging to a Moscow ISP so applying American or Canadian laws may prove difficult when attempting prosecution.

Beyond the application ADMSniff, the ADM Crew has created many other tools with even more questionable intention such as ADMspooof, ADMcrack, ADMworm and many others, which helps to demonstrate the intentions of the group and specifically the ADMSniff application.

Program Identification

ADMSniff was located at a number of ftp and Web Sites, however all of the sites contained one of two versions. For example, <http://online.securityfocus.com/tools/215/scoreit> contained version .08 and <http://adm.freelsd.net/ADM/> version 0.1b (The ADM Crew’s Web Site). Once statically compiled and stripped of all symbols, both of these versions did not turn out to be the same size or have the same MD5 checksum as “sn.dat”, however the programs did illustrate the same behavior and had the same functionality as sn.dat. See images 24.0-24.1

Image 24.0

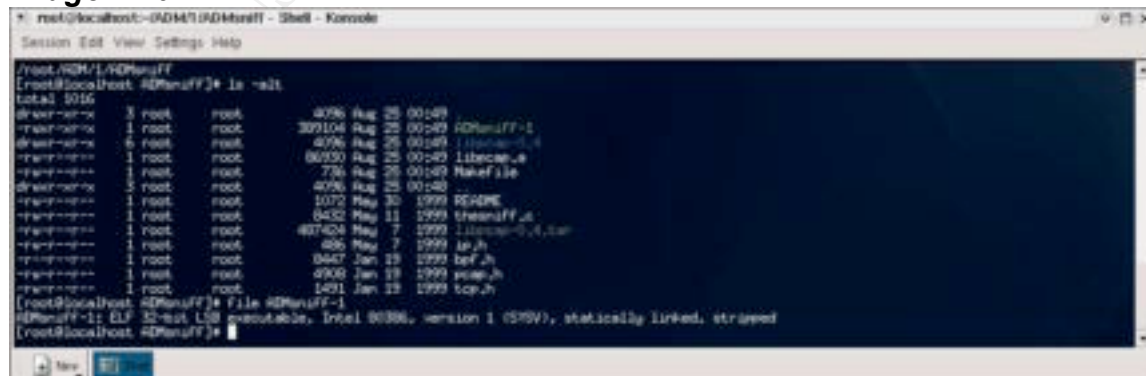
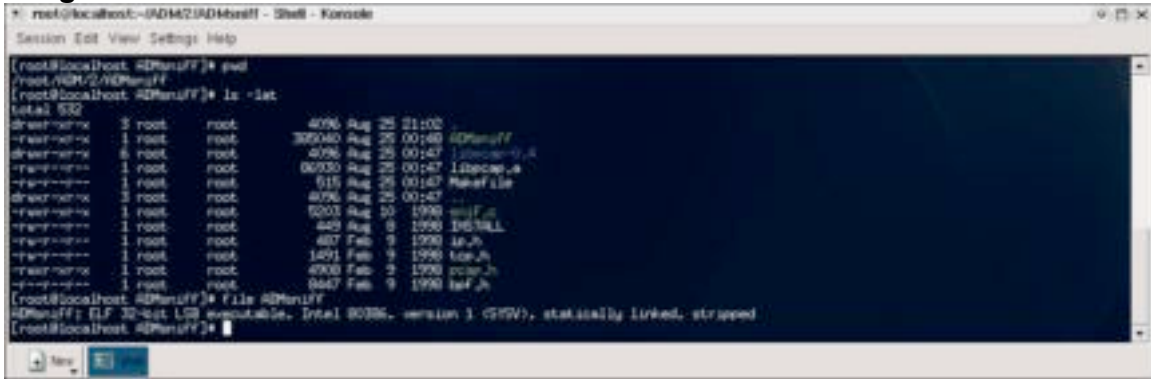
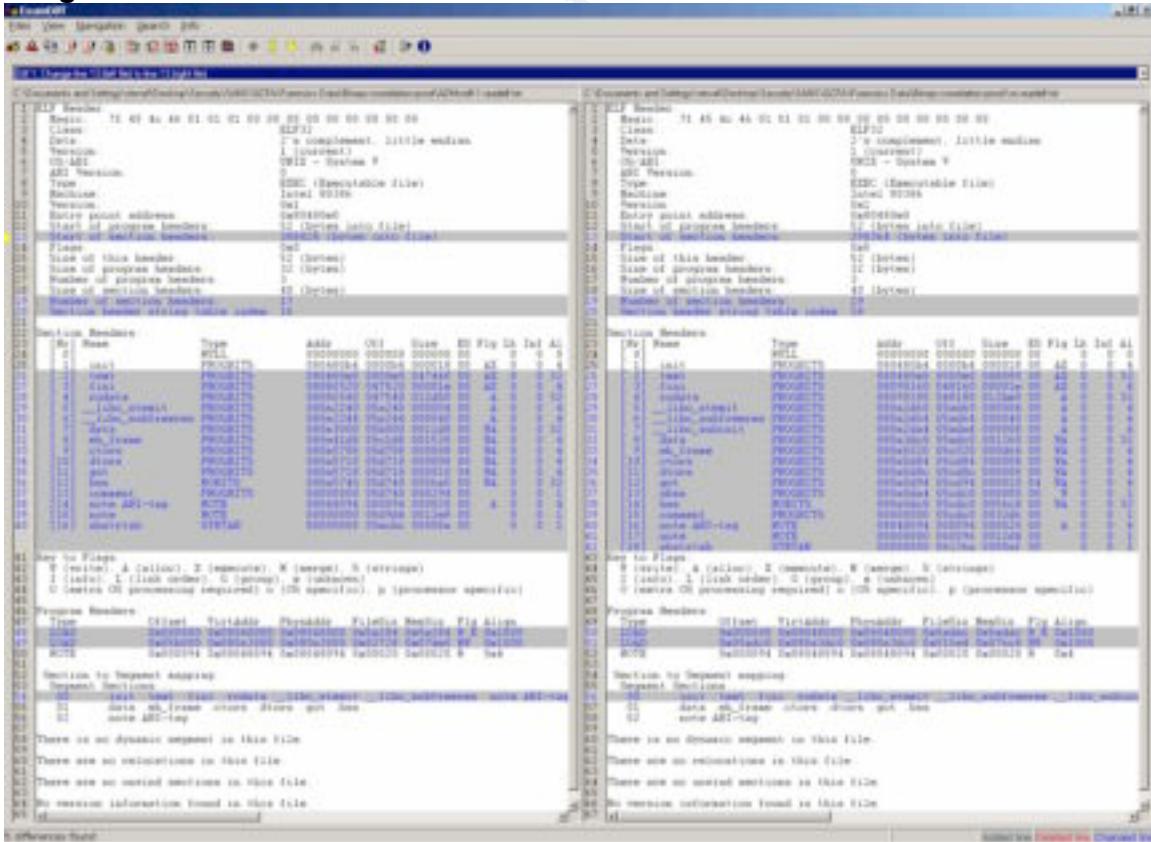


Image 24.1



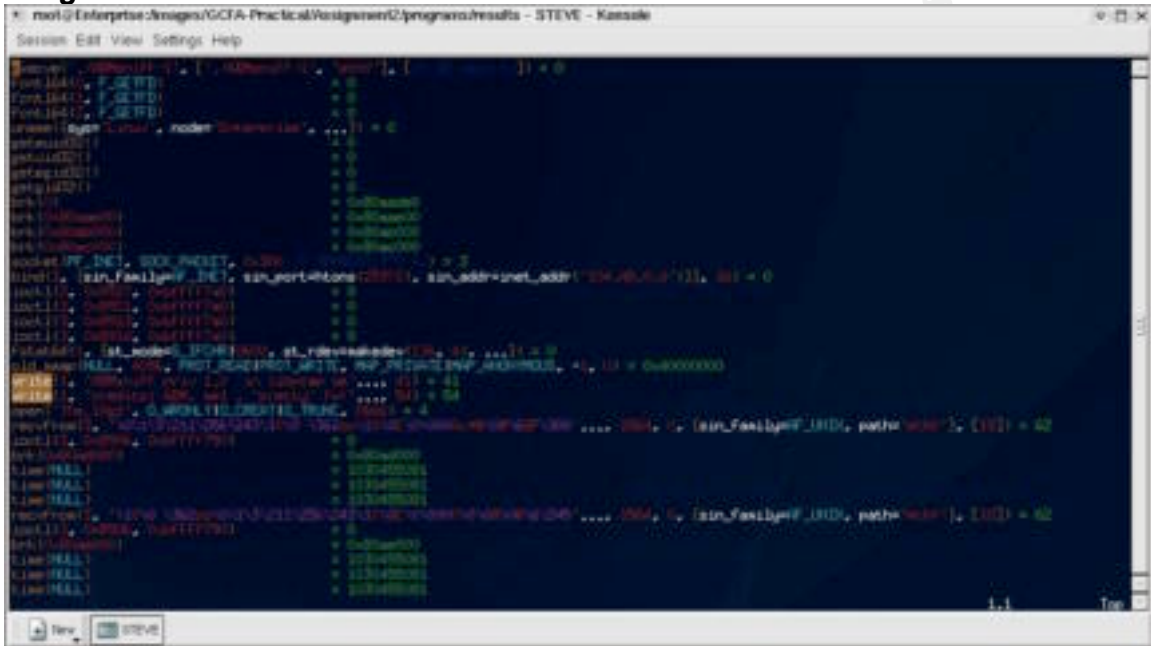
The results of comparisons between ADMsniff version 0.1b and sn.dat show these applications to be the same program with minor differences. These differences may be the result of the compiler used, the options given to it during compiling and the operating system it was compiled on and possibly other factors.

Image 25.0 contains the readelf comparisons of sn.dat and ADMsniff, which show similar values with most exceptions being differences in memory location used by the application and size of memory address space. See Image 25.0
Image 25.0



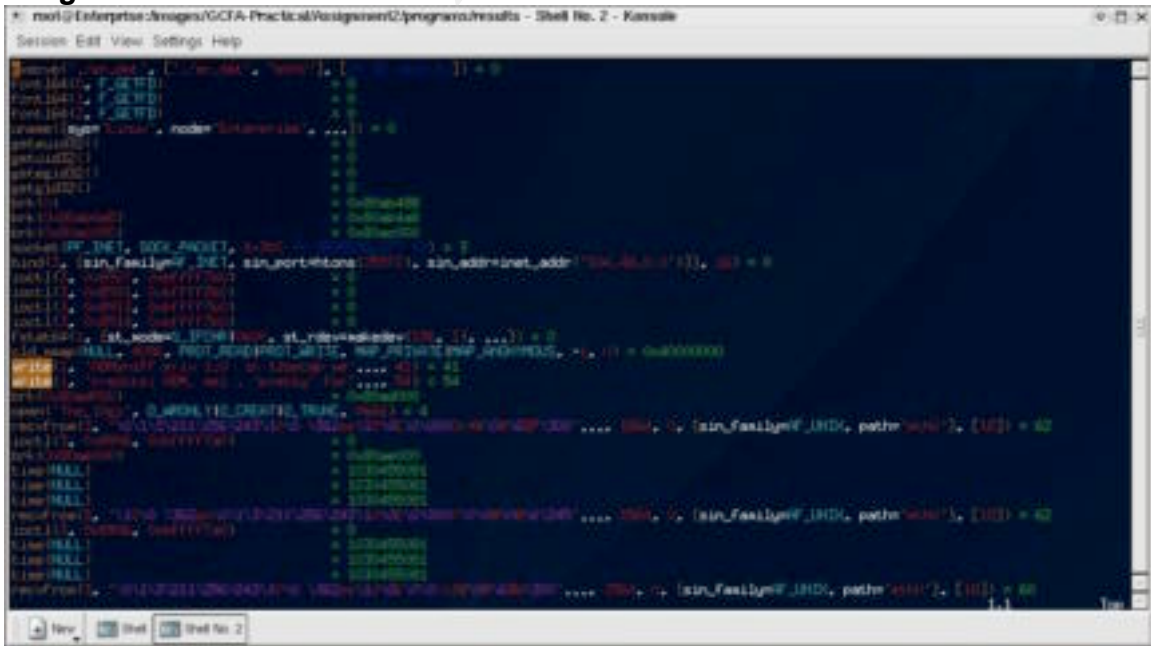
To perform a direct comparison between sn.dat and ADMsniff, strace was used to capture the system calls of both applications while running simultaneously. Further comparison between the two files utilizing strace, again, shows virtually identical output. In the screen shots below we see write processes outputting their data to the console such as the version number of the program, the references to the ADM Crew and other information that is identical between ADMsniff and sn.dat. The applications both display this information on execution from the shell prompt as seen in image 25.1 and 25.2.

Image 25.1



```
root@Enterprise:/images/GCFA-Practical/Assignment2/programs/results - STEVE - Konsole
Session Edit View Settings Help
[...]
```

Image 25.2



```
root@Enterprise:/images/GCFA-Practical/Assignment2/programs/results - Shell No. 2 - Konsole
Session Edit View Settings Help
[...]
```


have been broken in the Canadian legal system. The laws that may apply in this case are listed below.

Section 342.1 (1)-Criminal code of Canada. – Unauthorized Access

“Every one who, fraudulently and without color of right:”

- a) *obtains, directly or indirectly, any computer service,*
- b) *by means of an electro-magnetic, acoustic, mechanical or other device, intercepts or causes to be intercepted, directly or indirectly, any function of a computer system,*
- c) *uses or causes to be used, directly or indirectly, a computer system with intent to commit an offence under paragraph (a) or (b) or an offence under section 430 in relation to data or a computer system, or*
- d) *uses, possesses, traffics in or permits another person to have access to a computer password that would enable a person to commit an offence under paragraph (a), (b) or (c)*

Section 342.1 (1) would apply in this case because it is likely that the application “sn.dat” was compiled and installed to monitor the activity of systems administrators on a system that has been previously compromised by the attacker. This would thus prove the attacker obtained direct access to a computer service without authorization or legal right.

342.1(1) Penalties

...is guilty of an indictable offence and liable to imprisonment for a term not exceeding ten years, or is guilty of an offence punishable on summary conviction.

Section 430 (1.1)-Criminal code of Canada. -- Mischief to data

“Everyone commits mischief who willfully:”

- a) *Destroys or alters data*
- b) *Renders data meaningless, useless or ineffective.*
- c) *Obstructs, interrupts or interferes with the lawful use of data.*
- d) *Obstructs, interrupts or interferes with any person in the lawful use of data or denies access to data to any person who is entitled to access thereto*

Section 430(1.1) could be applied in this case because the hacker may be using the data captured in “The_I0gz” files to interrupt, obstruct or interfere the legitimate communications of the system.

430(1.1) Penalties

(2) Every one who commits mischief that causes actual danger to life is guilty of an indictable offence and liable to imprisonment for life.

(3) Every one who commits mischief in relation to property that is a testamentary instrument or the value of which exceeds one thousand dollars

(a) is guilty of an indictable offence and liable to imprisonment for a term not exceeding ten years; or

(b) is guilty of an offence punishable on summary conviction.

(4) Every one who commits mischief in relation to property, other than property described in subsection (3),

(a) is guilty of an indictable offence and liable for imprisonment for a term not exceeding two years; or

(b) is guilty of an offence punishable on summary conviction.

(5) Every one who commits mischief in relation to data

(a) is guilty of an indictable offence and liable to imprisonment for a term not exceeding ten years; or

(b) is guilty of an offence punishable on summary conviction.

(5.1) Every one who wilfully does an act or wilfully omits to do an act that it is his duty to do, if that act or omission is likely to constitute mischief causing actual danger to life, or to constitute mischief in relation to property or data,

(a) is guilty of an indictable offence and liable to imprisonment for a term not exceeding five years; or

(b) is guilty of an offence punishable on summary conviction.

Section 184(1) of the criminal code of Canada -- Interception

Every one who, by means of any electro-magnetic, acoustic, mechanical or other device, wilfully intercepts a private communication is guilty of an indictable offence and liable to imprisonment for a term not exceeding five years.

184(1) would apply since the sole purpose of "sn.dat" is to capture data from a system without authorization.

184(1) Penalties

... liable to imprisonment for a term not exceeding five years.

Section 326 of the criminal code of Canada -- Theft of telecommunication service

(1) *Every one commits theft who fraudulently, maliciously, or without color of right:*

(b) uses any telecommunication facility or obtains any telecommunication service.

(2) *Definition of "telecommunication"*

In this section and section 327, "telecommunication" means any transmission, emission or reception of signs, signals, writing, images or sounds or intelligence of any nature by wire, radio, visual or other electromagnetic system.

Section 326(1)(b) could be pursued since “sn.dat” is used to capture “writing of intelligence” over telecommunication by this definition.

326(1)(b) Penalties

... liable to imprisonment for a term not exceeding two years.

Canadian Criminal Code references ^{xii}

No proof of execution

As discussed above, the Canadian law system requires MENS REA and ACTUS REUS to be met for successful prosecution. If either of these requirements cannot be met then the next level of recourse should be an Information Security Policy, which can be effectively used to identify and mitigate internal and external threats. ^{xiii}

A comprehensively designed policy will outline the acceptable use of corporate resources and consequences of violation. Since there are several issues with running “questionable” applications such as ADMsniff, it is important to provide awareness training to employees so security is practiced and observed by all employees. Violation of the internal policies may be better identified to employees simply by making them aware of the business impact such activities can have. Some examples of this are as follows:

- Denial of service to corporate systems
- Legal liability → If, systems outside the corporation are attacked or compromised due to this activity.
- Data integrity issues → Due to events stemming from the execution of such applications.
- Data confidentiality issues → Due to events stemming from the execution of such applications.
- Loss of corporate reputation → Due to events stemming from the execution of such applications.

The risk imposed by employees compiling unknown code, and running it on corporate systems and networks needs to be clearly identified within the Acceptable Use Policy. It is also imperative these policies be well communicated to all employees and read and understood by all employees. Employees must realize the direct results of this activity can lead to system availability, confidentiality and data integrity breaches costing the company in areas including, loss of reputation, legal liability, and financial loss.

Interview Questions

1. Our network IDS picked up a file transfer to system X and it originated from your system. We then noticed a file system change on system X that our host based IDS picked up so we investigated. We discovered some applications used for troubleshooting network activity... (Obtain confirmation from subject) We're sure you were trying to troubleshoot a problem but these tools take a fair amount of disk space and we can't afford new drives... (Sympathize) ADMsniff is a pretty interesting tool... (Dig for the whole story, confirm specific application)
2. So, I understand you were trying out a sniffer on one of the systems. Management thinks you took down the network with it... (Confirmation). I would tell management right away that there is no way ADMsniff could break the network because it's just listens to packets... (Confirm Tool)
3. Developing and testing network sniffers during company time is conflict of interest because the company directly deals in network technologies. I would stop immediately or you may lose your job... (Make the person think they are in trouble for different reasons.) Besides, isn't that sniffer based in ADMsniff?
4. There are multiple sections of the Canadian criminal code that deal with the things you are doing on the network and management has told me to contact law enforcement because what you've done it illegal. Now, I don't really think it's a big deal but your going to have to help me understand what you were doing so I can help you out.
5. Hey, what is that stuff you installed on system X? That's really cool man. Can you teach me how to do that? I tried to use ADMsniff at home but didn't understand how. There doesn't seem to be a program only these .c and .h files.. This stuff is complicated! Do you understand it?? Can you show me how you got your copy of ADMsniff working?
6. We are trying to find out if telnet and ftp are working on system X and we have gone through the regular troubleshooting routines but have had no luck. I heard you have a nifty program that will log the data? Can we use that to help troubleshoot? Where is it? What's it called? Is there a newer version or did you just install it?
7. You understand who we are right? Corporate security... we have been watching you for the last while... you've been doing a lot of really questionable things... (Open ended statement, wait for confession). (Press) We know your associated with the hacker group and law enforcement is going to know soon. Espionage is a federal offence! We know because of that program you installed... Of course it's the least of your worries at this point... ADMsniff right?

Assignment 3 - Legal Issues of Incident Handling (Wiretap Statute)

Introduction

The basic foundation of the democracy of Canada is the Canadian Charter of Rights and Freedoms. The charter is the guiding principal governing the rights and freedoms of the citizens of Canada. The relevance of this Act of Constitution to wiretap laws is Section 8 of the charter, which states, "Everyone has the right to be secure against unreasonable search or seizure". This is the basis in which to apply the laws of Canada and specifically the effects of wiretap laws, better known in Canada as the Interception of Communication.

In the Canadian legal system there are a handful of laws that deal with wiretaps and each of these laws have specific requirements which need to be met for the law to be effective. In order to fully cover the aspects of wiretaps it is important to include law enforcements role and their powers and limitations during an investigation.

Various sections of Canadian law cover the interception of communications (wiretap laws) directly and indirectly. Specifically, section 184 of the Criminal Code of Canada outlines the interception of communication, defining when it is legal and illegal to intercept communications. This section of the criminal code states "everyone who intercepts a private communication is guilty of an indictable offence and liable to imprisonment for up to 10 years". Within this law are exceptions that can be applied to the system administrator role within and organization.

Communications Interception by System Administrators

184.1(a): Interception of Communications

Subsection (a) of Criminal Code 184 states "***either the originator of the private communication or the person intended by the originator to receive it has consented to the interception***". Section 184 applies to any person who has the consent of the sender or originator of the communication. Sections 184.2(2) of the criminal code states that this consent can be express or implied. This is important because it addresses implied and expressed consent, which is important within the System Administrator's authority to intercept and monitor communication. For example, if a company has developed, implemented and communicated a Security Policy to all it's employees, this can be considered as implied consent for the administrator to monitor communications because it could be argued the company is one half of the communications when employees conduct business for the company.

The Security Policy will normally have declarations that provide warnings to readers stating warnings similar to “all communications may be monitored on all corporate systems”. This type of statement informs employees that their use of corporate systems will be monitored and by their awareness of this notification via the security policy, they have consented to these actions.

The concept of systems owners is one in which a system within a company can be assigned to a person or job description, granting full ownership and decision making rights for that system. System owners can imply consent to the interception of communications by reading and consenting to the Security Policy as described above. Sometimes the system owner would be considered half of the private communication and thus has authority under section 184.1(a) to monitor communications. The system administrator has implied or expressed consent from the system owner then it would be legal for the system administrator to intercept communications.

814.2(iii) “Interception is legal if the purpose or intent is to protect the person’s rights and property directly related to providing the service”.

Section 814.2(iii) of the criminal code of Canada makes an allowance of system administrators to intercept traffic as part of normal activity in providing support of the system they administer by **“protecting the persons rights and property”**, which must be “directly related to providing the service”. This section allows administrators to intercept communications in multiple ways and using different technologies. In most cases, obtaining the justification to prove the system administrator was intercepting communications under this section would be fairly trivial.

An expectation of system administrators to provide the confidentiality, availability and integrity of the systems they manage provides implied consent in section 814.2(iii). Augmentation of this view would include supporting documentation, such as the system administrator’s job description, which would typically include duties and responsibilities directly related to providing the support of the systems. Service level agreements between a system owner and provider would demonstrate legal authorization in interception of communication through implied consent within section.

System administrators typically deploy technologies such as firewalls, Intrusion Detection systems, and other logging facilities. Exceptions to section 814.2(iii) may include detailed monitoring such as content filtering of email or targeting specific employees because neither of these examples are directly related to **“protecting the rights and property related to providing the service”**.

In a case where the communication lies outside the consent and authorization required of a systems administrator, section 184(b) can be applied if a law enforcement officer has satisfied the requirements in section 184(4).

184(4)

Allows law enforcement authorization to intercept communications in “Exceptional Circumstances”

1. Where there is an urgency in which authorization could not be obtained in time.
2. The interception may prevent immediate and serious harm to a person or property.

When none of the requirements within the laws in the Criminal Code have been satisfied, a System Administrator would be in violation of the law and subject to the penalties of breaking those laws.

Search and Seizure in Canada

Data that is considered stored such as email, application data or computer files located within a computer system or written to physical media would typically require the search and analysis of the system. In cases where interception is not possible, search and seizure laws may be applied. As in the United States, Canada has search and seizure laws that deal with data that is in a “stored state” as apposed to an “In transit” state. In order for law enforcement to seize computer systems, obtain files or search through data, they must have a warrant authorizing the “**search and seizure**” of computer equipment and/or the data in the system or other systems available to that system. To obtain authorization, law enforcement must obtain a warrant authorization by a legal justice.

The decision a justice makes to issue a warrant for search and seizure of computer equipment and data is made under the provisions of section 487(2.1) of the criminal code of Canada and within the Canadian Charter of Rights and Freedoms, Section 8. Section 8 is a catchall phrase that states, “**Everyone has the right to be secure against unreasonable search and seizure**”. However, within Section 487(2.1) of the criminal code, provisions are made for law enforcement to obtain a search warrant as long as they have satisfied a justice that they have reasonable grounds to believe that a law has been broken and the area they have identified in the warrant contains the information or evidence in question.

Section 487(2.1) A person authorized under this section to search a computer system in a building or place for data may

- (a) use or cause to be used any computer system at the building or place to search any data contained in or available to the computer system;*
- (b) reproduce or cause to be reproduced any data in the form of a print-out or other intelligible output;*
- (c) seize the print-out or other output for examination or copying; and*

(d) use or cause to be used any copying equipment at the place to make copies of the data.

An interesting question arises from part (a) of Section 487(2.1), stating that **“...any data contained in or available to the computer system”** ...can be searched or seized. Under this definition, and once a warrant has been authorized, law enforcement has been granted the ability to search any system, device and data that is available to this system.^{xiv xv}

The implications of this level of authorization are clearly realized when applied in a corporate business setting. The authority granted to law enforcement to search and seize computers and data based on their availability to other systems could cause significant business disruption. An example of this could be an employee who has installed software on his corporate computer system and is using it to compromise other systems outside of an organization. Law enforcement could execute a warrant to search and seize the employees computer system and all of the systems in which it connects. Since most employees would connect to systems, which allow them to perform their job functions such as mail servers, file servers, and database servers, part (a) of this section can be very disruptive to a business since all of these servers are “available” to the employee’s computer. In fact, in some cases this type of authority may cause a significant enough disruption to render a business unproductive during the investigation.

This type of authorization may create reluctance on the part of a systems administrator to include law enforcement in the investigation of an employee since there is no guarantee that the investigation will not take advantage of this law and potentially remove systems from the business for investigation purposes. However it would not be in law enforcements best interest to set this type of precedence since future cooperation from businesses would not be as forthcoming.

In order to avoid this type of situation, a system administrator can take a proactive approach, helping law enforcement while maintaining the complete availability of their systems. For example, if a users computer is suspected of misuse, the administrator can make read only images of the hard disk, run MD5 checksums against the original image and the copy and supply this information to law enforcement. The same can be said with data on systems “available” to the users computer such as mail servers, file servers and others.

Illegal interception

In the Canadian Charter of rights and freedoms, everyone has the right to be secure against unreasonable search or seizure. Because there are provisions in Canadian law to intercept communications for a variety of reasons, this does not permit system administrators or law enforcement to intercept private communications without justification or at will.

The various sections of the criminal code that allow systems administrators or law enforcement the flexibility to monitor traffic, including the protection of property, could be seriously challenged when there is no direct evidence requiring or granting authorization to intercept. Where a system administrator employs logging or monitoring such as Intrusion Detection, firewalls, or other technologies that log data with the intent of general collection systems they generally fall into the exceptions of the criminal code.

Where a system administrator directly monitors an individual and cannot prove the intent described above, they would not fall into the exceptions of the criminal code and thus may have violated the Charter of rights and freedoms and have created a criminal offense themselves. In situations where an administrator has access to networks or systems outside of their direct control or authorization, the exceptions in the criminal code would not apply. An important point to understand is when system administrators are attempting to track down unauthorized communications, hacking or troubleshooting common problems, they must be aware of when monitoring can cross the line between being on the right side of the law and when their actions bring them in violation of the law. Understanding how the law apply are essential to these types of situations and administrators should consult with their companies legal or human resources departments when unsure of their limitations.

Communications Interception by Law Enforcement

Sections 184(1)(2)(3) of the criminal code, outline law enforcements ability to intercept communications in Canada. Law enforcement's ability to intercept communications is more restrictive than that of the corporate system administrator. This is partly due to the fact that when law enforcement has a requirement to intercept communications it is with the intent of gathering evidence for some type of criminal prosecution. To intercept communications of private citizens law enforcement is required to meet expectations and requirements in Canadian law, ensuring they do not infringe on the rights of the citizen as granted in the Canadian Charter of Rights and Freedoms. Once law enforcement has met the requirements of the warrant and they have satisfied a judge, limitations still apply to the interception.

Law enforcement must meet the following requirements for the approval of communications interception:

1. Must provide particulars of the offence.
2. Must prove reasonable grounds that an offence has been committed.
3. Must include the name of the person consenting to the interception
4. The period of authorization should no exceed 60 days if requested in person.

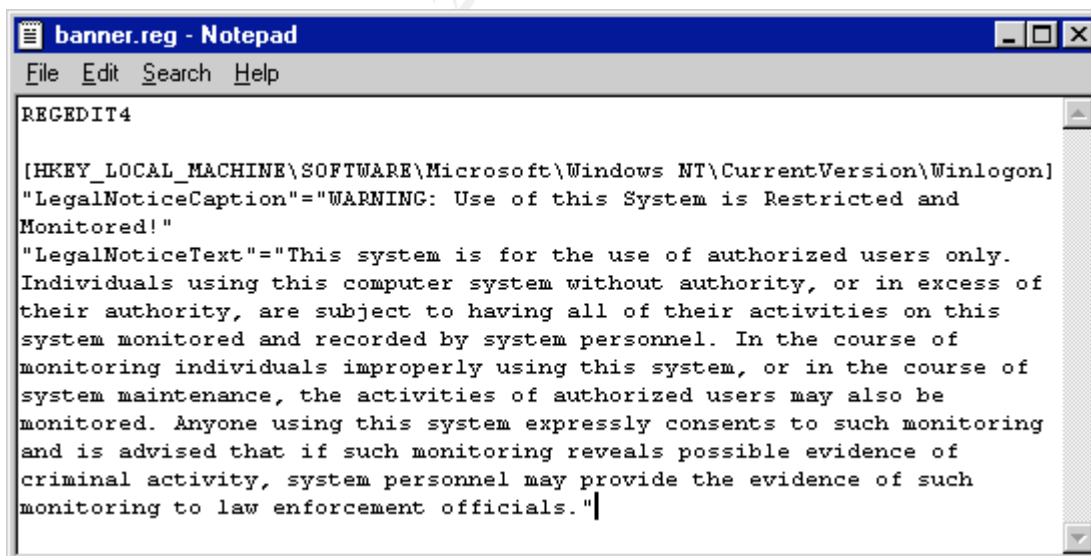
5. The period of authorization should no exceed 36 hours if not requested in person.
6. Have reasonable grounds that the information required will be obtained via the interception request.
7. State the type of communication to be intercepted.
8. Data must be destroyed as soon as practicable after the application for authorization.

Since there are somewhat significant restrictions placed on law enforcement when attempting to collect evidence for prosecution, it is advantageous for the system administrator to collect the data without the assistance of law enforcement since they have much greater freedom. There are potential problems with this method in that the system administrator must be well versed in evidence collection and appropriate procedures, otherwise their effort may not stand up when presented.

System & Device Banners

Placing banners on computer systems is a widely adopted practice used to identify the intended use and/or restrictions of a computer system. Information included in system banners generally pertains to the authorized use of the system, the intended users and penalties or laws that could be applied if violated.

An example of a typical banner is included below. This banner was taken from Carnegie Mellon, Software Engineering Institute – CERT Coordination Center and is applied via a system registry entry in Windows NT/2000. ^{xvi}



```
REGEDIT4

[HKKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Winlogon]
"LegalNoticeCaption"="WARNING: Use of this System is Restricted and Monitored!"
"LegalNoticeText"="This system is for the use of authorized users only. Individuals using this computer system without authority, or in excess of their authority, are subject to having all of their activities on this system monitored and recorded by system personnel. In the course of monitoring individuals improperly using this system, or in the course of system maintenance, the activities of authorized users may also be monitored. Anyone using this system expressly consents to such monitoring and is advised that if such monitoring reveals possible evidence of criminal activity, system personnel may provide the evidence of such monitoring to law enforcement officials."
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To implement a banner in a Unix environment, there are a few locations in which the banner can be placed. For general logins, banners are placed in /etc/motd and /etc/issue. Since the banners placed in /etc/motd and /etc/issue will only

appear when someone is attempting to login to a system, it is important to include banners in the other services that run on the system. For example, if you run a Lotus Notes server, you should apply the banner so when employees or others attempt a login, the banner is displayed. This applies to a multitude of services on all systems.

Computer systems connected to network infrastructures such as local area networks or large networks such as the Internet can be used or “seen” by people other than the intended users. As such, outside users are un-aware of the specific uses or restrictions placed on the particular system in question. This concept is especially true since it not only applies to citizens of the country the system resides but potentially to citizens outside of the country, which can complicate legal issues. Because people from other countries are typically not verse in the laws of another country it is important to make diligent attempts to inform people what they are connecting to, who is permitted to connect, and how communications and transactions are permitted on the system. Shown below are four samples of banners that can be used depending on your application. These have been taken from the Naval Sea Logistics Center Web Site.^{xvii}

(1)
DoD Warning Banner

Use of this or any other DoD interest computer system constitutes a consent to monitoring at all times.

This is a Department of Defense Computer System. This computer system, including all related equipment, networks and network devices (specifically including INTERNET ACCESS), are provided only for authorized U.S.

Government use. DOD Computer Systems may be monitored for all lawful purposes, including to ensure that their use is authorized, for management of the system, to facilitate protection against unauthorized access, and to verify security procedures, survivability and operational security. Monitoring includes active attacks by authorized DOD entities to test or verify the security of the system. During monitoring, information may be examined, recorded, copied and used for authorized purposes. All information, including personal information, placed on or sent over this system may be monitored.

Use of this DOD Computer System, AUTHORIZED or UNAUTHORIZED, constitutes consent to MONITORING of this system. UNAUTHORIZED use may SUBJECT YOU TO CRIMINAL PROSECUTION. EVIDENCE of UNAUTHORIZED use collected during monitoring may be used for administrative, criminal or adverse action. Use of this system constitutes consent to monitoring for these purposes.

Use of this or any other DoD interest computer system constitutes a consent to monitoring at all times.

(2)
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(3)

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(4)

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The Internet domain (for example, "xcompany.com" if you use a private Internet access account, or "yourschool.edu" if you connect from a university's domain) and IP address (an IP address is a number that is automatically assigned to your computer whenever you are surfing the Web) from which you access our website;

The type of browser and operating system used to access our site;

The date and time you access our site;

The pages you visit; and

If you linked to the current website from another website, the address of that website.

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An interesting point about placing banners on systems is the potential conflict with some security practices. The intent of a banner is to provide those

connecting to the system, information regarding the terms and conditions in using the systems and other relevant information.

Now consider that in computer security it is important to reduce your exposure and the risk to your systems in any way you can. One of the ways security professionals do this is to place misinformation or as little information as possible about the use of services residing on the system. For example, some applications present more of a security risk than others so security professionals will modify the banner information to misinform the user of the actual service in which they are connecting. In this case it may be that someone is connecting to your server and the banner they would typically see has been modified to say nothing, thus no terms and/or conditions information is displayed to the originator. This seems to be a double-edged sword since on one hand it seems reasonable to remove the banner in order to protect your system, and on the other hand the person is not made aware of the terms and conditions or legal ramifications of doing the wrong thing to your system. Of course, the opposite argument could be said, that displaying the banner to a hacker who resides in a country where criminal prosecution would be near impossible is futile and taking the obfuscation approach may be more effective.

There are several methods to placing warning banners on services as described above, however there is no current way to cover all the possible connections to a system. For example, there are 65535 TCP ports and 65535 UDP ports that services can use for their communication with other systems. The services covered above typically use the TCP protocol because it verifies the communication and delivery of packets. Problems arise when services or applications do not have a mechanism to deliver connection messages to the originator. In typical situations people connect to a system via a few well-known protocols and services such as ftp, telnet, or login. These services have mechanisms built in to display the intended legal or authorized use banner to the originator of the connection.

Issues to consider include applications that have no mechanism to display a banner, simply because the developer never saw the need. A choice must be made to use these applications or services with no banner or find an application, which is suitable for the given application and that has the ability to display a banner. Possible solutions to this problem may be a firewall or server capable of handling the connection requests for all ports running standard services. The firewall or server would answer connections and provide banner information by proxy. Once the user has read and accepted the banner, the connection would be passed to the appropriate system. This solution does provide a mechanism to pass required banner information to the originator for all services running on all ports, even when the services and ports are not open to the destination server.

While there certainly are problems with placing banners on all ports or services, applications do exist to enhance the functionality of banners. TCP Wrappers is

and application which is used as a front end for a variety of services. TCP Wrappers sends banner information based on the originator's IP address, which allows it to distinguish between authorized and unauthorized systems. When a computer attempts a connection that is not in the "hosts.allow" file, a banner can be displayed telling the originator that they are not an authorized user of the system. If a connection is made from a legitimate user whose IP address is in the "hosts.allow" file, a banner can be displayed with a message regarding the terms and conditions that applies to authorized users of the system and their consent to monitoring.^{xviii}

This type of setup may be used to reduce the problem of obfuscation described earlier because the banner displayed when an unauthorized IP address connects would be completely blank, revealing nothing about the service or application. Authorized users would still receive their standard banner. Of course the reverse argument is that the banner message serves a greater function by informing the unauthorized user of the terms and conditions of the system. The most beneficial deployment may be the use of a dual banner that removes the name and version of any given service for both authorized or unauthorized connections, only displaying the terms and conditions information based on the IP address.

Evolution of Canadian law

The current laws within the Canadian legal system are generally quite old in relation to computer crime as most came into effect in 1974. As computer technology continues to infiltrate the lives of everyone, Governments must apply or re-evaluate laws to keep up with the complexities of these technologies, and specifically how they are applied in criminal situations. The Canadian Department of Justice is pursuing ratification of the **Council of Europe's – Convention on Cyber Crime**, a treaty currently signed by 33 countries including Canada and most G8 members.^{xix}

The Convention on Cyber Crime endeavors to provide countries with the ability to better investigate and prosecute those who commit computer related crimes. Specifically, the treaty addresses the issue of international cooperation when investigating and prosecuting cyber-crimes, an imperative when dealing with crimes that regularly cross national borders. Other areas in which the treaty makes important inroads into the legal system are in the areas of procedural powers and the making of computer crimes. Although the Canadian legal system already has laws to deal with some of the suggestions within the Council of Europe Convention on Cyber-Crime, the treaty attempts to bring the legal system in step with the technologies of current computer systems, and provisions to deal with cyber-crime and powers to cross borders.

For Canada to move in step with some of its G8 partners and provide law enforcement with the tools and resources required in dealing with cyber-crime

the convention would require integration into current Canadian laws. Changes to the criminal code would include things such as requirements to ensure intercept capability, production orders, preservation orders and making the creation of malicious software a crime.

Enhancements to Intercept of Communications

There are no current requirements for service providers to build infrastructures that would allow law enforcement the ability to intercept communications. If the service provider is issued a warrant to comply with the interception of communications, it could be irrelevant since the service provider may not have the capability built into its' infrastructure.^{xx} The adoption and integration of the Council of Europe Convention on Cyber-Crime in the Canadian legal system would introduce laws that require service providers to build their infrastructure with interception capabilities. Although specifics have not been ironed out, the document suggests the new regulations would apply to new or significantly upgraded systems only.

Introduction of Production Orders

Although production orders exist within areas such as the competition act, they are specific and cannot be used with regards to the criminal code. If introduced in the Canadian legal system, law enforcement would have the ability to issue production orders to service providers in order to intercept and capture data specific to the production order. Production orders in this circumstance are of great benefit to law enforcement because service providers have the expertise and understanding of their infrastructure that law enforcement would not and thus are better suited to intercepting the information required. Other benefits are that law enforcement does not have to physically be at the service provider to intercept the communication, this is especially beneficial when there is an emergent situation.

Introduction of Preservation Orders

Currently, the Canadian legal system has no provisions for preservation orders. All service providers maintain various levels of client information and depending on the type of information it may have varying retention periods. Integration of the Council of Europe Convention on Cyber-Crime and preservation orders into Canadian law would allow law enforcement to have certain clients records or information preserved for a specific amount of time in order to obtain warrants, or production orders for the capture of the intended data.

Concept of unlawful creation of malicious software

Section 342(1)(2), and 430 of the Criminal Code of Canada addresses the unauthorized destruction or altering of data but does not include the actual

creation of applications or programs that have intentions of unauthorized alteration or destruction of data. In the Council of Europe Convention on Cyber-Crime document, provisions are outlined to make the creation of applications that are meant to destroy or alter data a criminal offense. Examples used within the document are computer viruses and the creation thereof.

Graphical Images MD5 Checksums

77454ca7c9ff601846edfa0c9c088e51 004.gif
d5545623058caa8560091cbd8dfb7607 005.gif
5c797af7f77f32eec97cf3bde5c1b667 006.png
13f386137e6138c232927016488ad8a6 007.jpg
cde31524583d495fd05c42d39a0eaaff 008.png
fd97d91f682664d7750f642df2b6f4e7 009.jpg
78e20cb7e336910509bf9def2f512254 010.png
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20615d1c7124c4f798a1d2b83e1a5694 012.png
f193f2f0a3ac2475e62ae97f0eeb39fc 013.jpg
f92dc4ba730b0fa73dc44b60ab83ef4f 014.png
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28b3f5e71ce3405fcb48643cef0ed96 036.png
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e41b9feb6782e86d11f11d66812d8476 038.png
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992d5e89289f95e7707d8aa79f6ffb82 041.jpg
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9b3bb42ded0d02b0b49bf5fe591193cd 043.jpg
6af1114395b0372a706e64f8576b2f11 044.png
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79e5995150eb24745f79015915caf923 046.png
c3229a41271cdaff42e284a81513995a 047.gif
2d35b01fc64f0df876f31f3e2ed52dcb 048.png
d8b2633371880fbb230c016fee00e936 049.gif
33ed13a2ab6cfb84358924028217c683 050.png
fba41d4614c9e026ad7a6bb2246e9cba 051.jpg

55fdbba26b4d072f48174065f98abdf5f 052.png
f1a450a7bb3508f16c1851a20fccfec3 053.jpg
91695ab7d79e4618381070e745e3b244 054.gif
ee57b4be5da19ab321585ac73a40e827 055.gif
9aecdfedb556c40a26eb2b81086a13d7 056.png
9e7cf9b709cfa2bc4ed88fcf92184e8b 057.jpg
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208d65b7cdb03c8a437d734046f01f74 063.jpg
46dbb408f0e23e1ea962a2d26b18eb2c 064.png
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5e4c934bdce22f71bcd53adac8450c4b 067.jpg
bd12c64086abff44472511dafa0f2729 068.png
801dbda81e7fb78bf18659a87f4ac7ee 069.jpg
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