Reference Books

- Cheswick and Bellovin, Firewalls and Internet Security, Addison-Wesley, 1994 (ISBN 0-201-63357-4)
- Garfinkel and Spafford, Practical UNIX Security, O'Reilly & Associates, 1991 (ISBN 0-937175-72-2)
- Schneier, Applied Cryptography, Wiley, 1994 (ISBN 0-471-59756-2)

Publications:

- Rik Farrow, "Barbarians at the Walls", Open Computing, Oct, 1994 pp 62-65.
- Dan Farmer, "Improving the Security of your Site by Breaking into it", (coast.cs.purdue.edu:/pub/doc/firewalls admin_guide_to_cracking)
- Safford, Schales, Hess, "The TAMU Security Package: An Ongoing Response to Internet Intruders in an Academic Environment", Proceedings Fourth USENIX Security Symposium, Oct 1993, pp. 91-118. (Also available via ftp from net.tamu.edu:pub/security/TAMU/tamu-security-overview.ps.gz)
- Cheswick, "The Design of a Secure Internet Gateway", coast.cs.purdue.edu:/pub/doc/firewalls/ Bill_Cheswick_secure_gateway

Texas A&M Network Security Tools

Free Tools:
(available from coast.cs.purdue.edu:/pub/tools)

- tcpwrapper
- TIS-toolkit (coast.cs.purdue.edu:/pub/mirrors/ftp.tis.com)
- socks
- TAMU
  - drawbridge
  - tiger
  - netlog/netwatch
- cops
- tripwire
- crack

Vendors:

- Sun - netra, firewall-1
- DEC - SEAL
- ANS - Interlock
- TIS - Gauntlet

- Checkpoint Technology - Firewall-1

Resources:

- Major FTP sites:
  - ftp.cert.org
  - coast.cs.purdue.edu
  - (drawbridge, netlog, tiger, SRA) - ftp://net.tamu.edu/pub/security/TAMU
  - PGP - http://web.mit.edu/network/pgp.html
  - SSL - http://home.mcom.com/newsref/std/sslref.html
  - SSLEAY - ftp://ftp.psy.uq.oz.au:/pub/Crypto

Resources:

- Organizations:
  - CERT
  - FBI
- Mailing Lists: (send "subscribe" in body to majordomo@)
  - Firewalls@greatcircle.com
  - Academic-firewalls@net.tamu.edu
- Newsgroups:
  - comp.security.announce (CERT)
  - comp.security.unix
  - alt.security

Drawbridge 2.0 Results

- Sustained Ethernet (486 ISA) improved from 2 to 5 Mbit
- Sustained FDDI (60 Mhz pentium) greater than 18 Mbit
- Full media bandwidth should be possible with:
  - faster cards (SMC ultra, Etherlink 3)
  - faster buses (PCI)
  - faster cpu (90 Mhz pentium)

Drawbridge 2.0 Tested Configurations

- Ethernet
  - 33 Mhz 486
  - DOS 5.0
  - ISA bus SMC elite 16 ethernet card
- FDDI
  - 60 Mhz pentium
  - DOS 5.0
  - EISA bus Network Peripherals FDDI card
  - (3-COM Fddilink does NOT work)

Drawbridge 2.0 Requirements

- >= 386 processor
- >= 2 MByte memory
- DOS 2.01 NDIS drivers
  - must support 2 NICs
  - must support promiscuous mode
  - must support native media frames

Drawbridge 2.0 Implementation

- Ethernet and FDDI support
- IP (UDP) stack for management
- Uses DOS NDIS 2.01 drivers
- Network tables in cached extended (XMS) memory
- Statistics reporting over IP
- Pseudo-one-time-pad encryption
- MIT style copyright (rather than GNU)

Drawbridge 2.0 Goals

- High speed support (T3 - 45 Mbit/sec)
- Hardware independence (wider card support)
- Media independence (ethernet, fddi, ...)
- Routable/portable management
- Better memory management

Filter tables

- Network tables
- Class table
- Allow table
- Reject table

Example Configuration File

```
# Defaults for any machine not listed in this file.
define default  <1-65535/udp in>, <!tftp/udp in>,
                <!sunrpc/udp in>, <!2049/udp in>,
                <1-65535 out>, <src=ftp-data in>,
                <smtp in>, <auth in>, <gopher in>;

# Admin requested no access in/out for this subnet
network 123.45.58.0 255.255.255.0 <!1-65535 in-out>;

# NNTP host and CSO phonebook server
host mailnews.tamu.edu    default, <nntp in>, <time in>,
                          <csnet-ns in>, <domain in>,
                          <finger in>;

# Machine (PC) which uses tftp to do document transfers
host sender.tamu.edu      <1-65535/udp in>;

# Has to have X
host arrow.tamu.edu       default, <ftp in>, <6000 in>;

# No TCP access in/out
host bee.tamu.edu         <!1-65535 in-out>;
```

Service Entry Grammar

```
<service_entry>   ::=  < (src=|dst=) <service_desc>
                         (in|out|inout) > |
                       <!(src=|dst=) <service_desc>
                         (in|out|inout) > |
                       < group_name>

<service_desc>    ::= <service> | <service_range>

<service>         ::= <port_number>                  |
                      <port_number>  / <protocol>   |
                      <service_name>                |
                      <service_name> / <protocol>

<service_range>   ::=  <port_number> - <port_number> |
                       <port_number> - <port_number> /
                       <protocol>
<protocol>        ::= <protocol_number> |
<protocol_name>
```

Filter Language Constructs

```
host (<hostname>|<ip_address>) <list of service_entries>

network (<ip_address>|<ip_address> - <ip_address>)
        <netmask> <list of service_entries>

define <group_name> <list of service_entries>

allow <ip_address> <netmask> <list of service_entries>

reject <ip_address> <netmask>
```

Encryption Problems

- U.S. Government restrictions
  - ITAR
  - Clinton's proposed new national cryptography policy
    - key length under 64 bits
    - no triple DES
    - required key escrow with no interoperability
- Without strong encryption, no global internet commerce
- Strong encryption freely available inside and outside U.S.

TCP Wrappers

- reduce exposure as much as possible
- particularly important for key services
  - telnet, ftp, r'commands
- does not help with UDP services
  - NFS, tftp...

Encryption

- Secure mail
  - PEM - privacy enhanced mail
  - PGP - pretty good privacy
- Secure telnet
  - SRA - secure RPC authentication
  - STEL - secure telnet
  - Future - PGP based telnet authentication
- Secure transactions
  - SSL - secure socket layer (Netscape)
  - SKIP - Sun's equivalent

Overview of Checks

- login accounts
- anonymous FTP
- NFS exports
- inetd configuration
- .netrc files
- PATH setting
- file permissions
- digital signatures
- embedded pathnames
- e-mail aliases
- cron files
- group file(s)
- known break-in signs
- passwd file(s)
- printcap file(s)
- .rhosts files
- file system scan

Host Checks:

- TAMU's tiger scripts
  - easy to use, with detailed messages and explanations
  - security configuration auditing
  - security patch verification
  - intrusion detection

Netwatch Example Output

```
09/16/93 01:29:43.63 [rpc] x.y.4537 HOST.TAMU.EDU RPC
                lookup for: ypserv

09/16/93 01:36:23.80 [rpc] x.y.4565 SUN.TAMU.EDU RPC
                lookup for: ypserv

09/19/93 11:24:13.89 [ftp] a.b.1025 PLANET.TAMU.EDU
                'anonymous' (u@a.b) unknown cmd:
                cat ANNOUNCE

09/19/93 14:41:38.11 [rpc] SUN.TAMU.EDU.4552 r.m.com RPC
                lookup for: rexd

09/20/93 22:52:48.70 [telnet] d.e.1090 VMS.TAMU.EDU
                attempted login as 'field'

09/20/93 22:52:48.77 [telnet] d.e.1090 VMS.TAMU.EDU
                failed login as 'field'
```

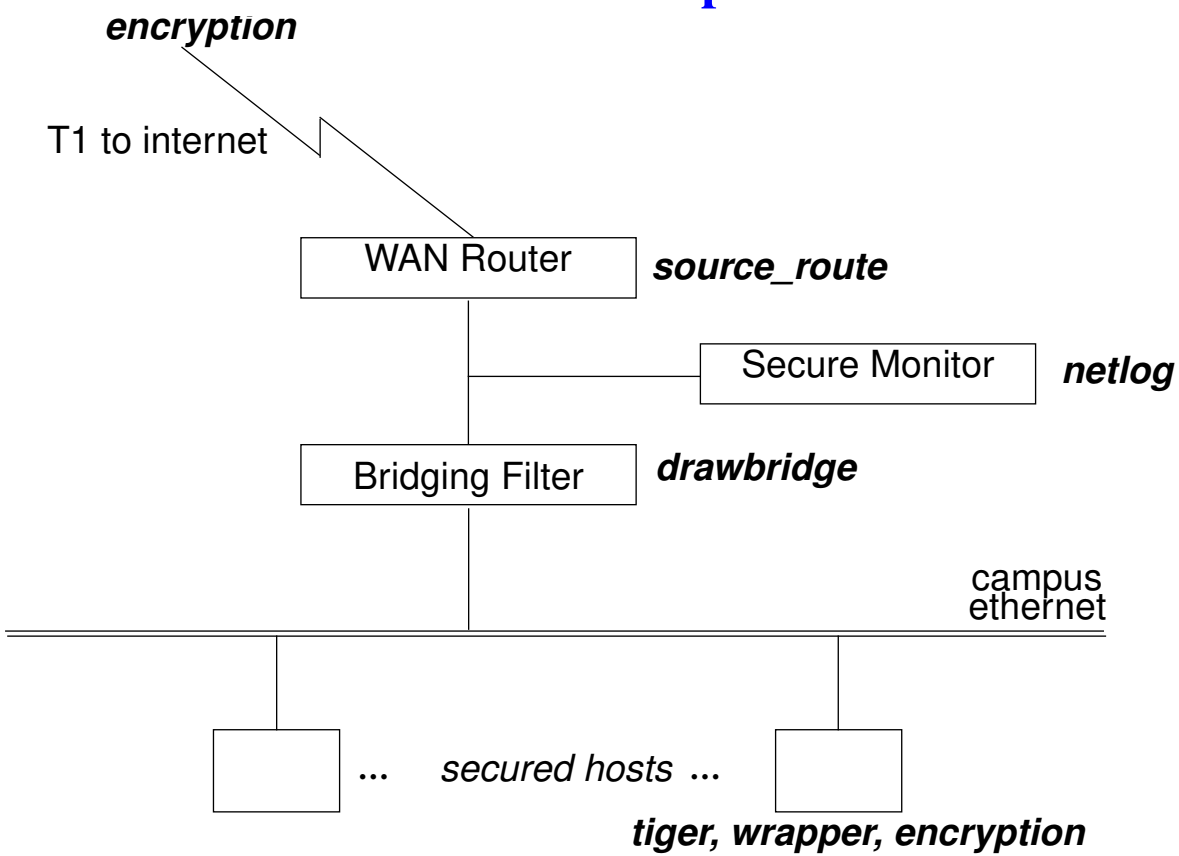
Network Monitors:

- TAMU's netlog:
  - tcplog
  - udplog
  - netwatch - intrusion detection
    - telnet, ftp, rlogin, rshell, smtp, tftp, sunrpc, FSP

Source Route Prevention

- easily added to most WAN routers (Cisco, 3Com...)
- prevents packet with source route option
- (thus prevents off-site IP spoofing of internal hosts)
- Vendors have published instructions on how to do it.

Overview of Components



Approaches:

- The big 6:
  - prevent source routing
  - firewalls
  - TCP wrapper
  - network monitors
  - host checks
  - encryption (PEM, SSL, PGP, SRA, STEL)
- The forgotten 3:
  - Passworded Dial-ups, particularly SLIP/PPP
  - “Secure” twisted pair ethernet hubs
    (we use 3-COM FMS-2 stackable)
  - Backups

Problem:

- internet hacker underground
- typical unix workstation misconfigured.
  - NFS exports, inetd.conf, hosts.equiv
- software bugs
  - AIX login, sendmail, syslog, netscape
- sniffing (weakest link)
- U.S. government restrictions (ITAR)
- => unprotected sites are at grave risk
- If you don't protect yourself, you will be broken into.
  - TAMU breakins August 92
  - UT breakins
  - Rice breakins

Abstract

- Problem
- Approaches
  - Overview
  - Monitor (netlog)
  - Host Check (tiger)
  - Filter (Drawbridge)
- Resources
- References
- Questions

- Postscript copy of this presentation available from net.tamu.edu:pub/security/TAMU/piec95.ps, along with original USENIX article tamu-security-overview.ps

Texas A&M Network Security Tools

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