Security

jnlin (2020-2021)
? (~ 2019)

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Security Principles

- Network Security is a very very big issue, can not full covered in this course
  - Aimed at security issues of single host
- KISS: Keep it simple and stupid
  - Minimum exposure to the Internet
    - Stop unused service and application
- Principles
- Keep your application and system updated (like Windows Update)
- Follow security advisories
  - FreeBSD
  - Linux: distro related
    - https://ubuntu.com/security/notices

FreeBSD Security Advisories

- http://www.freebsd.org/security/advisories.html

FreeBSD Security Advisories

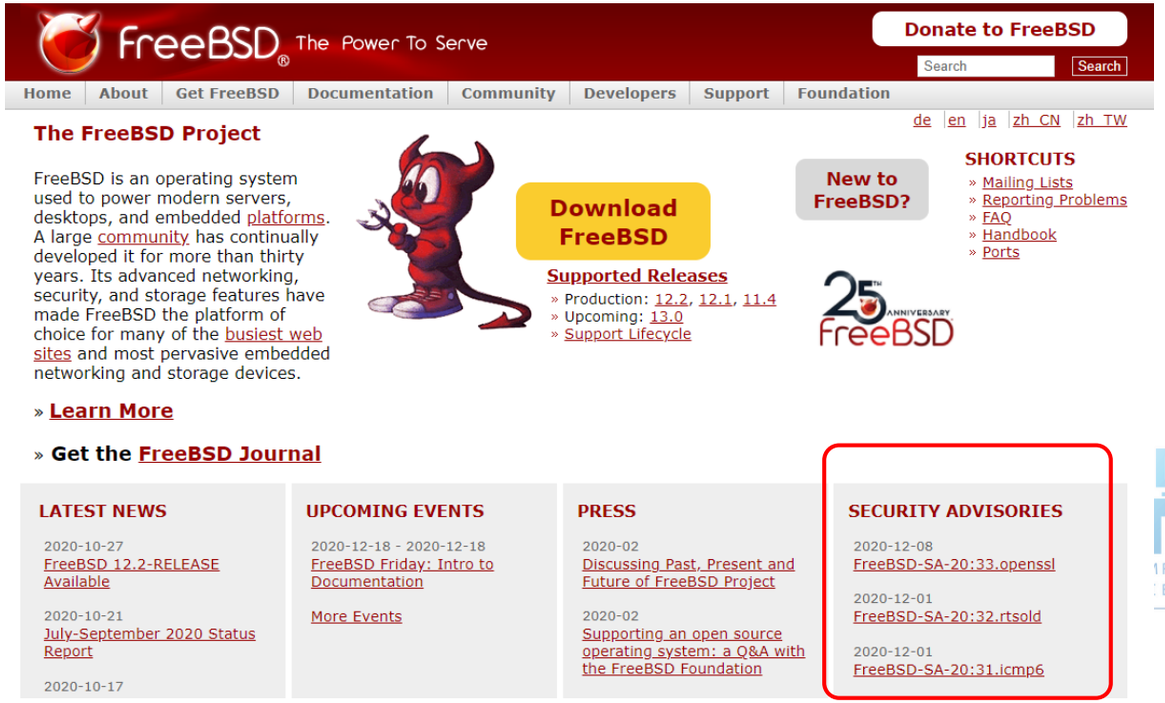
This web page contains a list of released FreeBSD Security Advisories. See the FreeBSD Security Information page for general security information about FreeBSD.

Issues affecting the FreeBSD Ports Collection are covered in the FreeBSD VuXML document.

Date	Advisory name
2020-12-08	FreeBSD-SA-20:33.openssl
2020-12-01	FreeBSD-SA-20:32.rtsold
2020-12-01	FreeBSD-SA-20:31.icmp6

FreeBSD Security Advisories

- Advisory
  - Security information
- Where to find it
  - Web page (Security Advisories Channel)
    - https://www.freebsd.org



FreeBSD Security Advisories

- Where to find it
  - freebsd-security-notifications Mailing list
  - http://lists.freebsd.org/mailman/listinfo/freebsd-security-notifications

Subscribing to freebsd-security-notifications

Subscribe to freebsd-security-notifications by filling out the following form. You will be sent email requesting confirmation, to prevent others from gratuitously subscribing you. This is a hidden list, which means that the list of members is available only to the list administrator.

Your email address:	
Your name (optional):	

You may enter a privacy password below. This provides only mild security, but should prevent others from messing with your subscription. **Do not use a valuable password** as it will occasionally be emailed back to you in cleartext.

If you choose not to enter a password, one will be automatically generated for you, and it will be sent to you once you've confirmed your subscription. You can always request a mail-back of your password when you edit your personal options.

Pick a password:	
Reenter password to confirm:	
Which language do you prefer to display your messages?	English (USA)

Would you like to receive list mail batched in a daily digest? ◉ No ○ Yes

Subscribe

FreeBSD Security Advisories

- Example
  - openssl: https://www.freebsd.org/security/advisories/FreeBSD-SA-20:33.openssl.asc

```
-----BEGIN PGP SIGNED MESSAGE-----
Hash: SHA512

=====================================================================
FreeBSD-SA-20:33.openssl                                Security Advisory
                                                      The FreeBSD Project

Topic:          OpenSSL NULL pointer de-reference

Category:       contrib
Module:         openssl
Announced:      2020-12-08
Affects:        All supported versions of FreeBSD.
Corrected:      2020-12-08 18:28:49 UTC (stable/12, 12.2-STABLE)
                2020-12-08 19:10:40 UTC (releng/12.2, 12.2-RELEASE-p2)
                2020-12-08 19:10:40 UTC (releng/12.1, 12.1-RELEASE-p12)
CVE Name:       CVE-2020-1971
```

CVE: Common Vulnerabilities and Exposures

FreeBSD Security Advisories

- CVE-2018-12207
  - https://nvd.nist.gov/vuln/detail/CVE-2018-12207

CVE-2018-12207 Detail

MODIFIED

This vulnerability has been modified since it was last analyzed by the NVD. It is awaiting reanalysis which may result in further changes to the information provided.

Current Description

Improper invalidation for page table updates by a virtual guest operating system for multiple Intel(R) Processors may allow an authenticated user to potentially enable denial of service of the host system via local access.

Source: MITRE

CVSS: Common Vulnerability Scoring System

FreeBSD Security Advisories

- Example
  - Problem Description

```
I.   Background

The Intel machine check architecture is a mechanism to detect and report
hardware errors, such as system bus errors, ECC errors, parity errors, and
others.  This allows the processor to signal the detection of a machine
check error to the operating system.

II.  Problem Description

Intel discovered a previously published erratum on some Intel platforms can
be exploited by malicious software to potentially cause a denial of service
by triggering a machine check that will crash or hang the system.

III. Impact

Malicious guest operating systems may be able to crash the host.
```

FreeBSD Security Advisories

- Example
  - Workaround

```
IV.  Workaround

No workaround is available.  Systems not running untrusted guest virtual
machines are not impacted.
```

FreeBSD Security Advisories

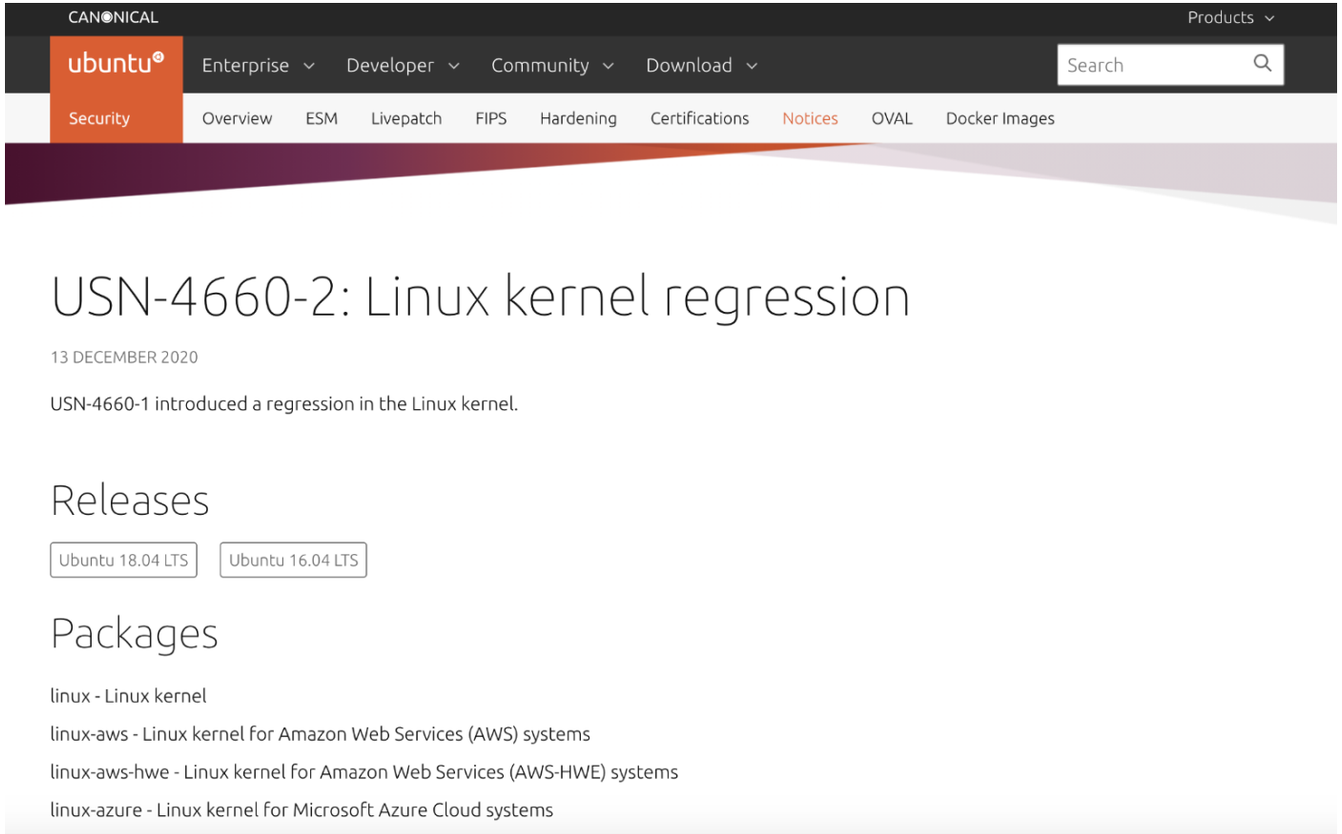
- Example
  - Solution
    - Upgrade to
    - Source code patch
    - Binary patch

```
V.   Solution

Upgrade your vulnerable system to a supported FreeBSD stable or
release / security branch (releng) dated after the correction date,
and reboot.

Perform one of the following:

1) To update your vulnerable system via a binary patch:

Systems running a RELEASE version of FreeBSD on the i386 or amd64
platforms can be updated via the freebsd-update(8) utility:

# freebsd-update fetch
# freebsd-update install
# shutdown -r +10min "Rebooting for a security update"
```

```
2) To update your vulnerable system via a source code patch:

The following patches have been verified to apply to the applicable
FreeBSD release branches.

a) Download the relevant patch from the location below, and verify the
detached PGP signature using your PGP utility.

[FreeBSD 12.1]
# fetch https://security.FreeBSD.org/patches/SA-19:25/mcepsc.12.1.patch
# fetch https://security.FreeBSD.org/patches/SA-19:25/mcepsc.12.1.patch.asc
# gpg --verify mcepsc.12.1.patch.asc

[FreeBSD 12.0]
# fetch https://security.FreeBSD.org/patches/SA-19:25/mcepsc.12.0.patch
# fetch https://security.FreeBSD.org/patches/SA-19:25/mcepsc.12.0.patch.asc
# gpg --verify mcepsc.12.0.patch.asc

[FreeBSD 11.3]
# fetch https://security.FreeBSD.org/patches/SA-19:25/mcepsc.11.patch
# fetch https://security.FreeBSD.org/patches/SA-19:25/mcepsc.11.patch.asc
# gpg --verify mcepsc.11.patch.asc

b) Apply the patch.  Execute the following commands as root:

# cd /usr/src
# patch < /path/to/patch

c) Recompile your kernel as described in
<URL:https://www.FreeBSD.org/handbook/kernelconfig.html> and reboot the
system.
```

Ubuntu Security Notices

- Where to find it
  - https://ubuntu.com/security/notices
- Example



Ubuntu Security Notice

- Details

Details

USN-4660-1 fixed vulnerabilities in the Linux kernel. Unfortunately, that update introduced a regression in the software raid10 driver when used with fstrim that could lead to data corruption. This update fixes the problem.

Original advisory details:

It was discovered that a race condition existed in the perf subsystem of the Linux kernel, leading to a use-after-free vulnerability. An attacker with access to the perf subsystem could use this to cause a denial of service (system crash) or possibly execute arbitrary code. (CVE-2020-14351)

It was discovered that the frame buffer implementation in the Linux kernel did not properly handle some edge cases in software scrollback. A local attacker could use this to cause a denial of service (system crash) or possibly execute arbitrary code. (CVE-2020-14390)

It was discovered that the netfilter connection tracker for netlink in the Linux kernel did not properly perform bounds checking in some situations. A local attacker could use this to cause a denial of service (system crash). (CVE-2020-25211)

Ubuntu Security Notice

- Update instructions
  - Use apt-get to update packages

Update instructions

The problem can be corrected by updating your system to the following package versions:

Ubuntu 18.04

linux-image-4.15.0-1061-oracle - 4.15.0-1061.67

linux-image-4.15.0-1076-gke - 4.15.0-1076.81

linux-image-4.15.0-1081-kvm - 4.15.0-1081.83

linux-image-4.15.0-1090-aws - 4.15.0-1090.95

linux-image-4.15.0-1090-gcp - 4.15.0-1090.103

linux-image-4.15.0-1093-snapdragon - 4.15.0-1093.102

linux-image-4.15.0-1102-azure - 4.15.0-1102.113

linux-image-4.15.0-128-generic - 4.15.0-128.131

linux-image-4.15.0-128-generic-lpae - 4.15.0-128.131

linux-image-4.15.0-128-lowlatency - 4.15.0-128.131

Common Security Problems

- Software bugs
  - FreeBSD security advisor
  - pkg audit
    - pkg-audit(8)
    - lynis https://cisofy.com/lynis/
- Unreliable wetware
  - Phishing site
- Open doors
  - Weak password
    - Lack of 2 factor authentication
  - Disk share with the world

pkg audit (1)

- pkg audit
  - Checks installed ports against a list of security vulnerabilities
  - pkg audit -F
    - -F: Fetch the current database from the FreeBSD servers.
- Security Output

pkg audit (2)

- pkg audit -F

```
Fetching vuln.xml.bz2: 100%  694 KiB 710.2kB/s    00:01
libxml2-2.9.4 is vulnerable:
libxml2 -- Multiple Issues
CVE: CVE-2017-9050
CVE: CVE-2017-9049
CVE: CVE-2017-9048
CVE: CVE-2017-9047
CVE: CVE-2017-8872
WWW: https://vuxml.FreeBSD.org/freebsd/76e59f55-4f7a-4887-bcb0-11604004163a.html

1 problem(s) in the installed packages found.
```

- http://www.freshports.org/<category>/<portname>
  - https://www.freshports.org/databases/postgresql96-server/

pkg audit (3)

FRESHports

We also have a status page: https://freshports.wordpress.com/

Port details

postgresql96-server PostgreSQL is the most advanced open-source database available anywhere

9.6.6 databases Σ=5

Maintainer: pgsql@FreeBSD.org

Port Added: 05 Sep 2016 11:15:47

License: PostgreSQL

```
PostgreSQL is a sophisticated Object-Relational DBMS, supporting
almost all SQL constructs, including subselects, transactions, and
user-defined types and functions. It is the most advanced open-source
database available anywhere. Commercial Support is also available.

The original Postgres code was the effort of many graduate students,
undergraduate students, and staff programmers working under the direction of
```

lynis

- lynis audit system
  - Can use lynis for remote system auditing

```
[+] System Tools
------------------------------------
  - Scanning available tools...
  - Checking system binaries...

[+] Plugins (phase 1)
------------------------------------
 Note: plugins have more extensive tests and may take several minutes to complete

  - Plugin: pam
    [..]
  - Plugin: systemd
    [................]

[+] Boot and services
------------------------------------
  - Service Manager                                           [ launchd ]
    - Boot loader                                             [ NONE FOUND ]

[+] Kernel
------------------------------------

[+] Memory and Processes
------------------------------------
  - Searching for dead/zombie processes                       [ FOUND ]
  - Searching for IO waiting processes                        [ NOT FOUND ]

[+] Users, Groups and Authentication
------------------------------------
  - Administrator accounts                                    [ OK ]
  - Unique UIDs                                               [ OK ]
  - Unique group IDs                                          [ OK ]
  - Unique group names                                        [ OK ]
  - Query system users (non daemons)                          [ DONE ]
  - Sudoers file(s)                                           [ FOUND ]
  - PAM password strength tools                               [ SUGGESTION ]
  - PAM configuration file (pam.conf)                         [ NOT FOUND ]
  - PAM configuration files (pam.d)                           [ FOUND ]
  - LDAP module in PAM                                        [ NOT FOUND ]
  - Determining default umask
    - umask (/etc/profile and /etc/profile.d)                 [ OK ]
```

Common trick

- Tricks
  - ssh scan and hack
    - ssh guard
    - sshit
    - …
  - Phishing
  - XSS & SQL injection
  - …
- Objective
  - Spam
  - Jump gateway
  - File sharing
  - …

Process file system – procfs

- Procfs
  - A view of the system process table
  - Normally mount on /proc
  - mount -t procfs proc /proc

```
last pid:  8103;  load averages:  0.00,  0.03,  0.04
102 processes: 1 starting, 1 running, 100 sleeping
CPU states:  0.2% user,  0.0% nice,  1.7% system,  0.7% interrupt, 97.4% idle
Mem: 305M Active, 1402M Inact, 215M Wired, 81M Cache, 112M Buf, 3016K Free
Swap: 4096M Total, 352K Used, 4096M Free

  PID USERNAME   THR PRI NICE   SIZE    RES STATE  C   TIME   WCPU COMMAND
 4576 tyhsieh      1  76    0  1964K  1652K select 1  56:05  0.00% httpd
 4566 tyhsieh      1  76    0  1672K  1360K select 0   6:13  0.00% httpd
 4584 tyhsieh      1  76    0  1996K  1052K select 0   1:24  0.00% httpd
```

```
hscc[/proc/4566] -chiahung- ls -al
total 0
dr-xr-xr-x  1 tyhsieh  hscc   0 Jan  3 13:53 ./
dr-xr-xr-x  1 root     wheel  0 Jan  3 13:53 ../
-r--r--r--  1 tyhsieh  hscc   0 Jan  3 13:53 cmdline
--w-------  1 tyhsieh  hscc   0 Jan  3 13:53 ctl
-r--r--r--  1 tyhsieh  hscc   0 Jan  3 13:53 etype
lr--r--r--  1 tyhsieh  hscc   0 Jan  3 13:53 file@ -> /home/tyhsieh/.etcdir/.etcvar/.etcexec/.etcvar/httpd
-r--r--r--  1 tyhsieh  hscc   0 Jan  3 13:53 map
-r--r--r--  1 tyhsieh  hscc   0 Jan  3 13:53 rlimit
-r--r--r--  1 tyhsieh  hscc   0 Jan  3 13:53 status
```

Simple SQL injection example

- Username/password authentication

```
SELECT * FROM usrTable
WHERE user =
AND pass = ;
```

- No input validation

```
SELECT * FROM usrTable
WHERE user = 'test'
AND pass = 'a' OR 'a' = 'a'
```

setuid program

- passwd
  - /etc/master.passwd is of mode 600 (-rw-------) !

```
$ ls -al /usr/bin/passwd
-r-sr-xr-x  2 root  wheel  8224 Dec  5 22:00 /usr/bin/passwd
```

- Setuid shell scripts are especially apt to cause security problems
  - Minimize the number of setuid programs

```
/usr/bin/find / -user root -perm -4000 -print |
/bin/mail -s "Setuid root files" username
```

  - Disable the setuid execution on individual filesystems
    - -o nosuid

Security issues

- /etc/hosts.equiv and ~/.rhosts
- Trusted remote host and user name DB
  - Allow user to login (via rlogin) and copy files (rcp) between machines without passwords
  - Format:
    - Simple: hostname [username]
    - Complex: [+-][hostname|@netgroup]
      [[+-][username|@netgorup]]
  - Example
    - bar.com foo (trust user "foo" from host "bar.com")
    - +@adm_cs_cc (trust all from amd_cs_cc group)
    - +@adm_cs_cc -@user123
- Do not use this

Why not su nor sudo?

- Becoming other users
  - A pseudo-user for services, sometimes shared by multiple users

```
User_Alias newsTA=user123
Runas_Alias NEWSADM=news
newsTA  ALL=(NEWSADM) ALL
```

  - sudo -u news -s (?) Too
  - /etc/inetd.conf
    - login stream tcp nowait root /usr/libexec/rlogind rlogind
  - ~notftpadm/.rhosts
    - localhost user123 Not secure
  - rlogin -l news localhost

Security tools

- nmap
- john, crack
- PGP
- CA
- …

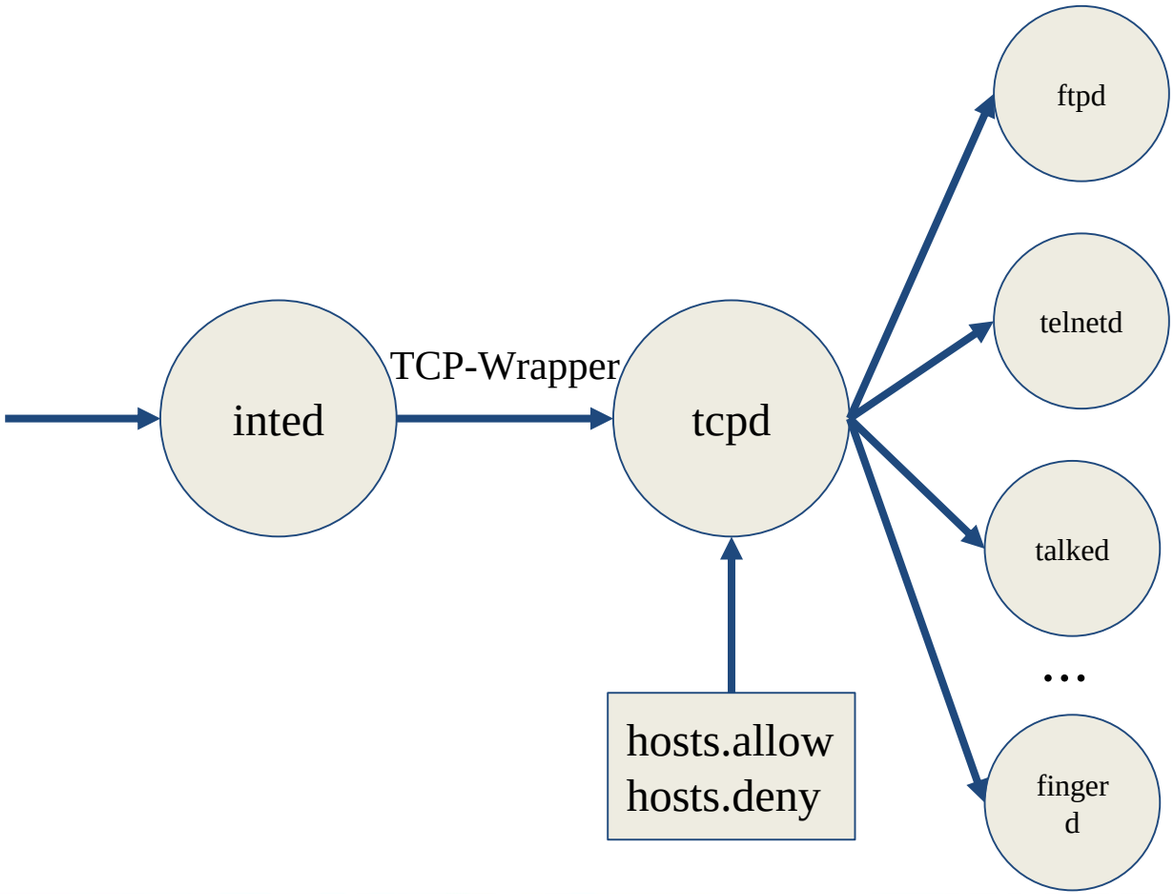
- Firewall
- TCP Wrapper
- …

TCP Wrapper

- There are something that a firewall will not handle
  - Sending text back to the source
- TCP wrapper
  - Extend the abilities of inetd
    - Provide support for every server daemon under its control
  - Logging support
  - Return message
  - Permit a daemon to only accept internal connections

TCP Wrapper

- TCP Wrapper
  - Provide support for every server daemon under its control



TCP Wrapper

- To see what daemons are controlled by inetd, see /etc/inetd.conf

```
#ftp    stream  tcp     nowait  root    /usr/libexec/ftpd       ftpd -l
#ftp    stream  tcp6    nowait  root    /usr/libexec/ftpd       ftpd -l
#telnet stream  tcp     nowait  root    /usr/libexec/telnetd    telnetd
#telnet stream  tcp6    nowait  root    /usr/libexec/telnetd    telnetd
shell   stream  tcp     nowait  root    /usr/libexec/rshd       rshd
#shell  stream  tcp6    nowait  root    /usr/libexec/rshd       rshd
login   stream  tcp     nowait  root    /usr/libexec/rlogind    rlogind
#login  stream  tcp6    nowait  root    /usr/libexec/rlogind    rlogind
```

- TCP wrapper should not be considered a replacement of a good firewall. Instead, it should be used in conjunction with a firewall or other security tools

TCP Wrapper

- To use TCP wrapper
  - inetd daemon must start up with "-Ww" option (default) or edit /etc/rc.conf

/etc/rc.conf

```
inetd_enable="YES"
inetd_flags="-wW"
```

    - Edit /etc/hosts.allow
      - Format:
        daemon:address:action
        - daemon is the daemon name which inetd started
        - address can be hostname, IPv4 addr, IPv6 addr
        - action can be "allow" or "deny"

        - Keyword “ALL” can be used in daemon and address fields to means everything

/etc/hosts.allow

- First rule match semantic
  - Meaning that the configuration file is scanned in ascending order for a matching rule
  - When a match is found, the rule is applied and the search process will be stopped
- E.g.,

```
ALL :     localhost, loghost @adm_cc_cs : allow
ptelnetd pftpd sshd: @sun_cc_cs, @bsd_cc_cs, @linux_cc_cs : allow
ptelnetd pftpd sshd: zeiss, chbsd, sabsd : allow
identd :  ALL : allow
portmap :  140.113.17. ALL : allow
sendmail : ALL : allow
rpc.rstatd : @all_cc_cs 140.113.17.203: allow
rpc.rusersd : @all_cc_cs 140.113.17.203: allow
ALL : ALL : deny
```

/etc/hosts.allow

- Advanced configuration
  - External commands (twist option)
  - twist will be called to execute a shell command or script

```
# The rest of the daemons are protected.
telnet : ALL \
         : severity auth.info \
         : twist /bin/echo "You are not welcome to use %d from %h."
```

- External commands (spawn option)
  - spawn is like twist, but it will not send a reply back to the client

```
# We do not allow connections from example.com:
ALL : .example.com \
      : spawn (/bin/echo %a from %h attempted to access %d >> \
      /var/log/connections.log) \
      : deny
```

/etc/hosts.allow

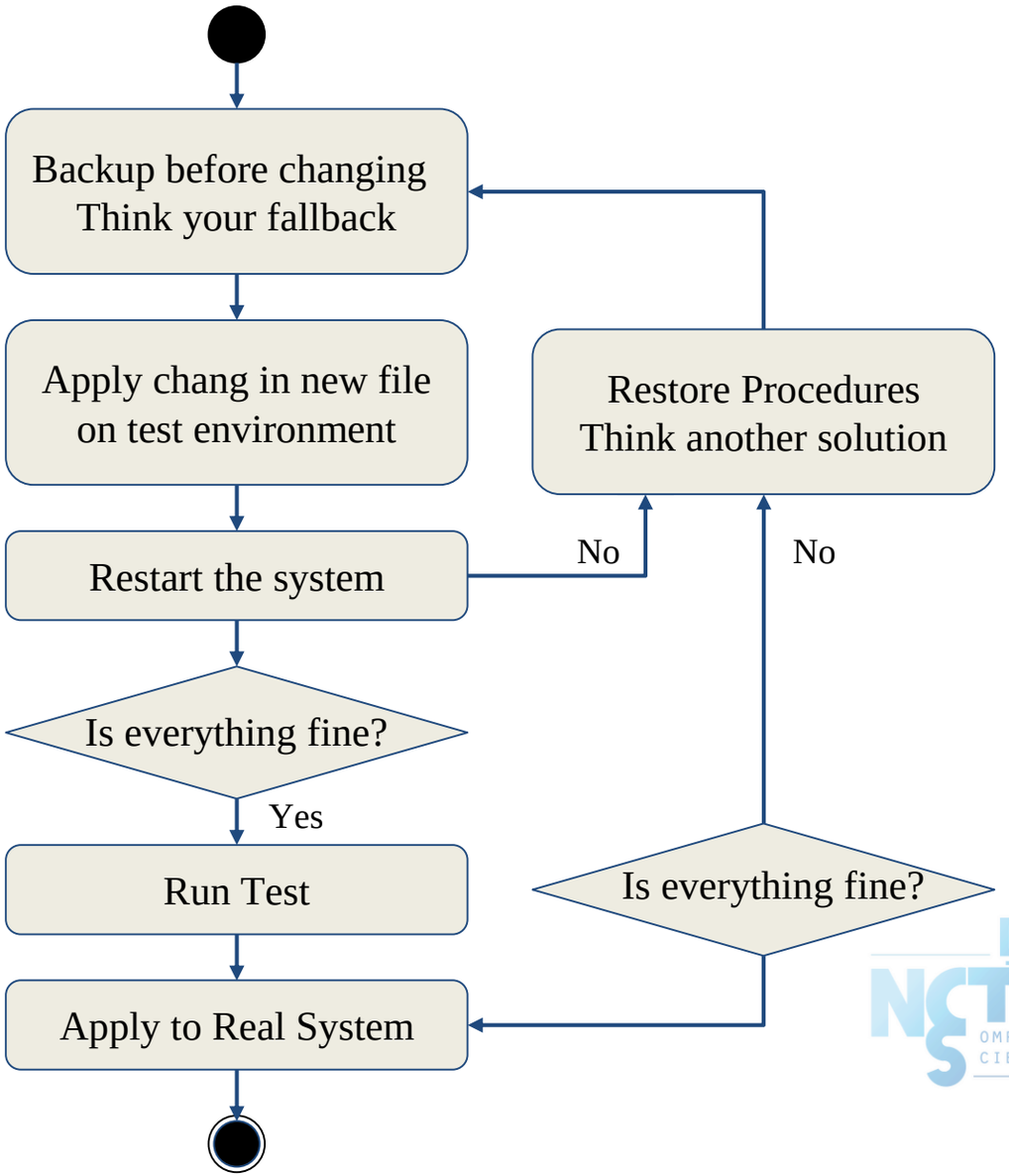
- Wildcard (PARANOID option)
  - Match any connection that is made from an IP address that differs from its hostname

```
# Block possibly spoofed requests to sendmail:
sendmail : PARANOID : deny
```

- See
  - hosts_access(5)
  - hosts_options(5)

When you perform any change.

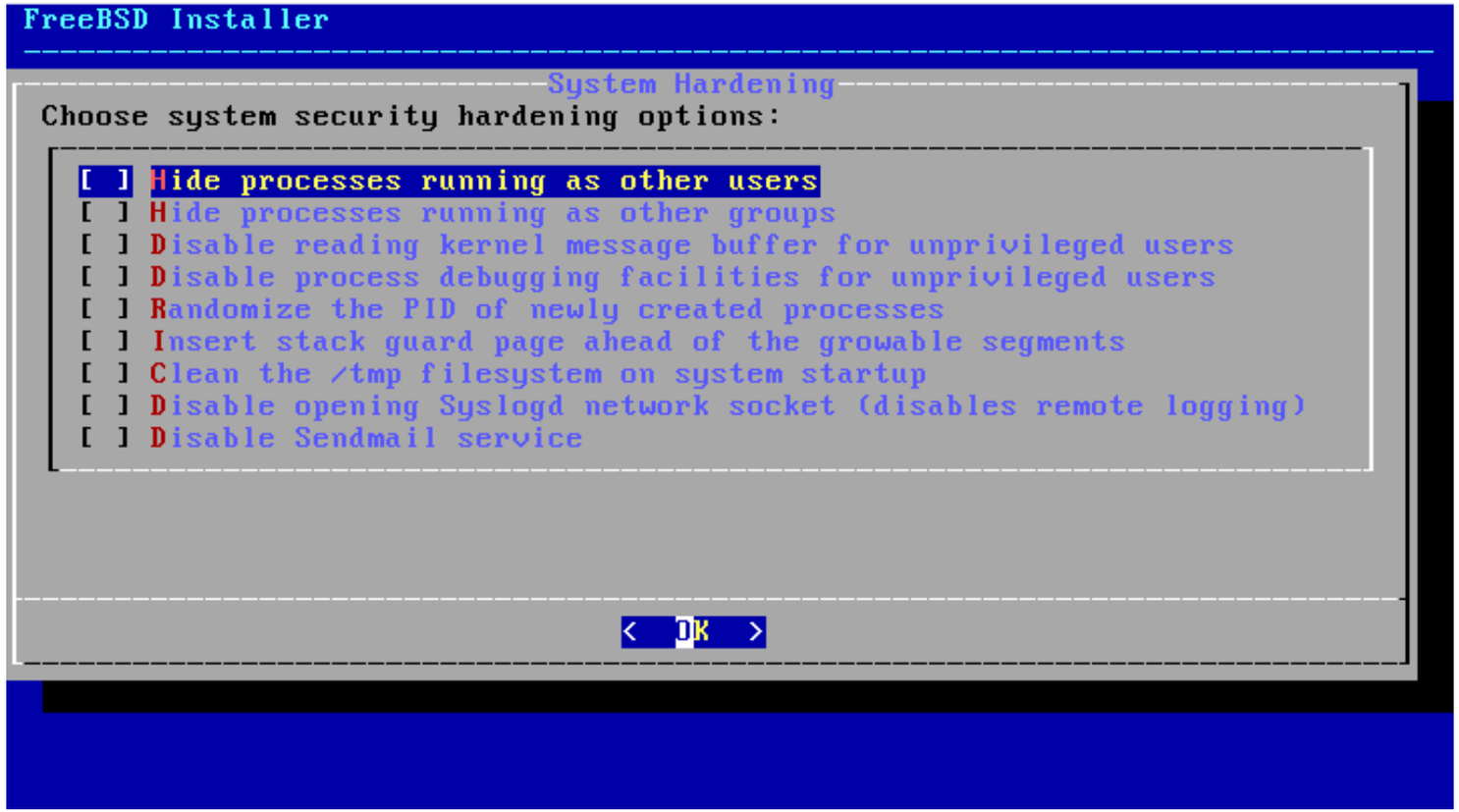
- Philosophy of SA
  - Know how things really work.
  - Plan it before you do it.
  - Do a full backup
  - Make it reversible
  - Make changes incrementally.
  - Test before you unleash it .



Appendix

System Security Hardening Options (1/3)

- Include various system hardening options during installation since FreeBSD 11.0-RELEASE
  - /usr/src/usr.sbin/bsdinstall/scripts/hardening



System Security Hardening Options (2/3)

- Hide processes running as other users
  - security.bsd.see_other_uids=0
  - Type: Integer, Default: 1
- Hide processes running as other groups
  - security.bsd.see_other_gids=0
  - Type: Integer, Default: 1
- Disable reading kernel message buffer for unprivileged users
  - security.bsd.unprivileged_read_msgbuf=0
  - Type: Integer, Default: 1
- Disable process debugging facilities for unprivileged users
  - security.bsd.unprivileged_proc_debug=0
  - Type: Integer, Default: 1

System Security Hardening Options (3/3)

- Randomize the PID of newly created processes
  - kern.randompid=$(jot -r 1 9999)
    - Random PID modulus
  - Type: Integer, Default: 0
- Insert stack guard page ahead of the growable segments
  - security.bsd.stack_guard_page=1
  - Type: Integer, Default: 0
- Clean the /tmp filesystem on system startup
  - clear_tmp_enable="YES" (/etc/rc.conf)
- Disable opening Syslogd network socket (disables remote logging)
  - syslogd_flags="-ss" (/etc/rc.conf)
- Disable Sendmail service
  - sendmail_enable="NONE" (/etc/rc.conf)