UNIX/Linux Auditing

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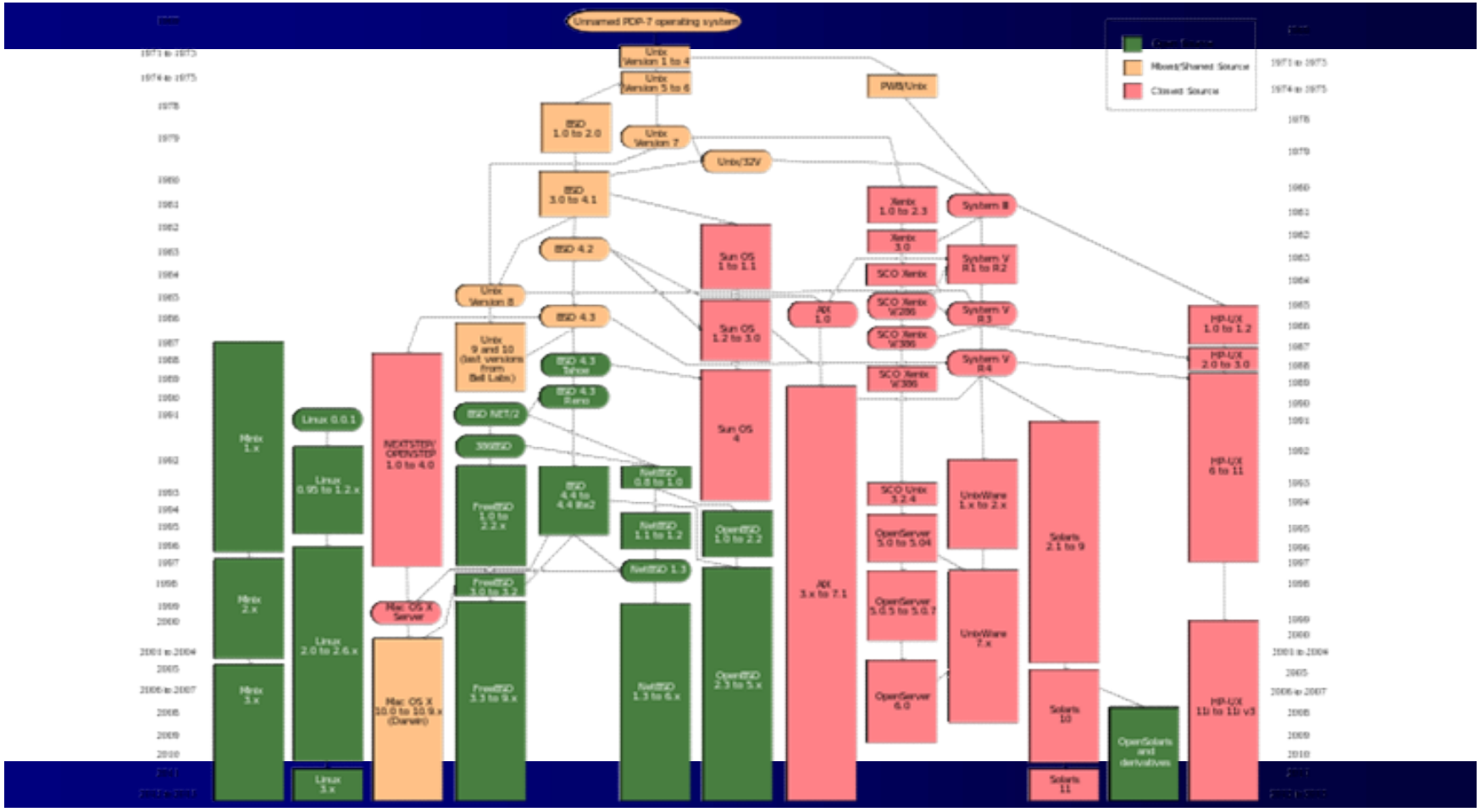
Training Events – www.securityaudits.org/events.html

***CISSP Course being offered April 25-April 29, 2016

Overall Agenda

- **Background**
- Users/Groups
- Permissions
- Passwords
- Patching
- Auditing/Logging

UNIX



Reference: http://en.wikipedia.org/wiki/Unix

UNIX “Philosophies”

- Do one thing and do one thing well
- Originally built with the developer in mind
- Everything is treated as a file

Logical File System (1)

- /etc
  - The “brains”
  - Contains the administrative files, including the configuration files for different services.
  - Users, passwords, messages, and tab files
  - Similar to the Windows registry
- /bin
  - Contains binary files, or executable files
  - At times the bin directory is also linked to other directories such as /usr/bin
  - Today executables are stored in multiple locations
- /sbin
  - Contains binaries including system binaries, daemons, and administrative programs
- /home
  - Usually the location of user home directories

Logical File System (2)

- /root
  - Often the home directory for root's files
  - Different than the "root directory"
- /usr
  - Contains the files that are used by multiple users of the system, including some administrative tools
  - Home directories can be placed here too
- /var
  - Contains variables or rapidly changing data
    - logfiles
    - spools, such as the mailqueue
- /proc
  - Contains information about processes

Logical File System (3)

- /lib
  - Contains the shared libraries
- /dev
  - Contains the device files
    - monitors, disk drives, CD-ROMs, printers, memory
  - Should only be writable by root
- /mnt
  - Reserved for mounting removable file systems
- /boot
  - Contains most of the files involved in constructing or running the bootstrap
- /tmp
  - Contains temporary files

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User Key Principles

Principle of Least Privilege

Separation of Duties

Rotation of Duties

/etc/passwd

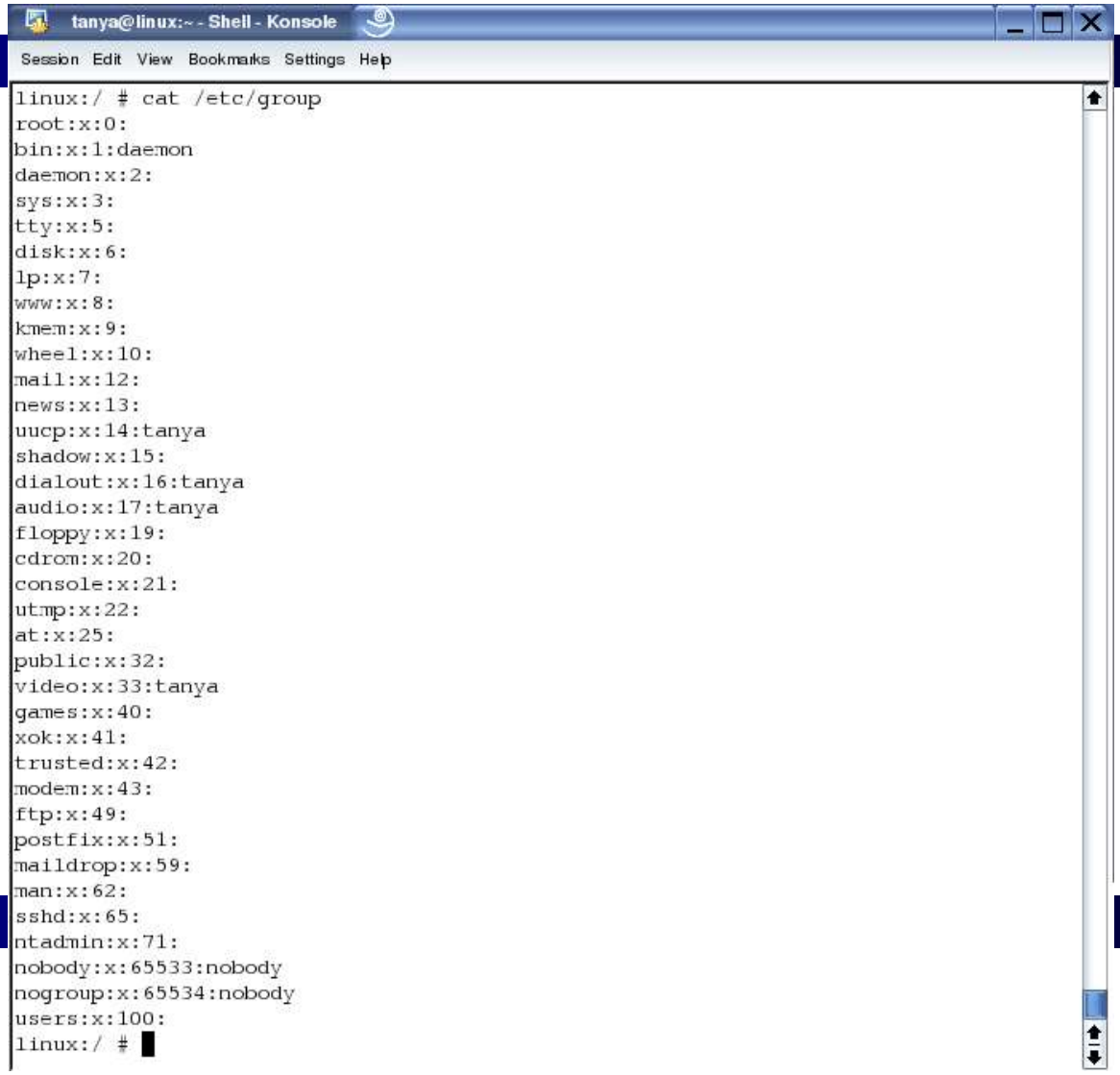
- Lists users on the system
- Contains 7 fields separated by a ":"
  - Name – the username
  - Password – password field
    - Should have an "x"
  - UserID – user's identification
    - Watch out for accounts with a UID of "0"
    - Look for duplicate IDs
  - PrincipleGroup – user's group ID (GID)
  - Gecos – stores the user's full name
  - HomeDirectory – user's home directory
  - Shell – user's default shell

Sample /etc/passwd

/etc/group

- Lists groups on the system
- Each line in the file names a group
- The primary group that a user belongs to is listed in the /etc/passwd file
- Contains 4 fields separated by a ":"
  - Group name – gives the group name
  - Encrypted password – gives the group password
  - Group ID – group identification number
  - List of comma-separated users who are in the group
- Commands: groups, id, chage -l

Sample /etc/group



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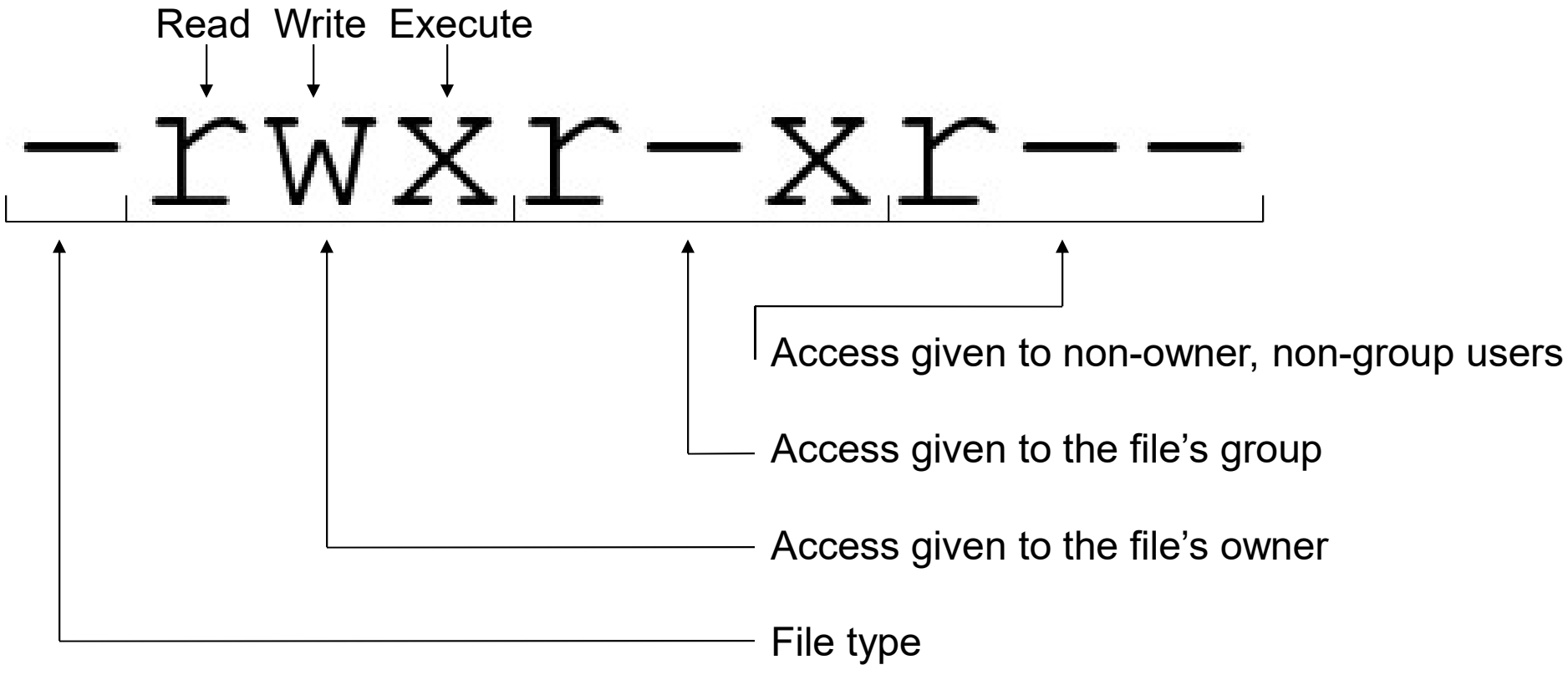
Permissions



Directory Permissions

- r = List the contents of the directory
  - List the file names
- w = create, delete, rename files in the directory
- x = can ‘cd’ into the directory, access contents, not list contents
  - List information from the inode – information about the files
  - Need access to the inode to be able to read/write files in the directory
- Permissions do not grant users the right to run certain *programs*, they grant the right to use certain *system calls*
  - Ex. ‘cat’/’more’ – written using read() system call, so read permission is necessary

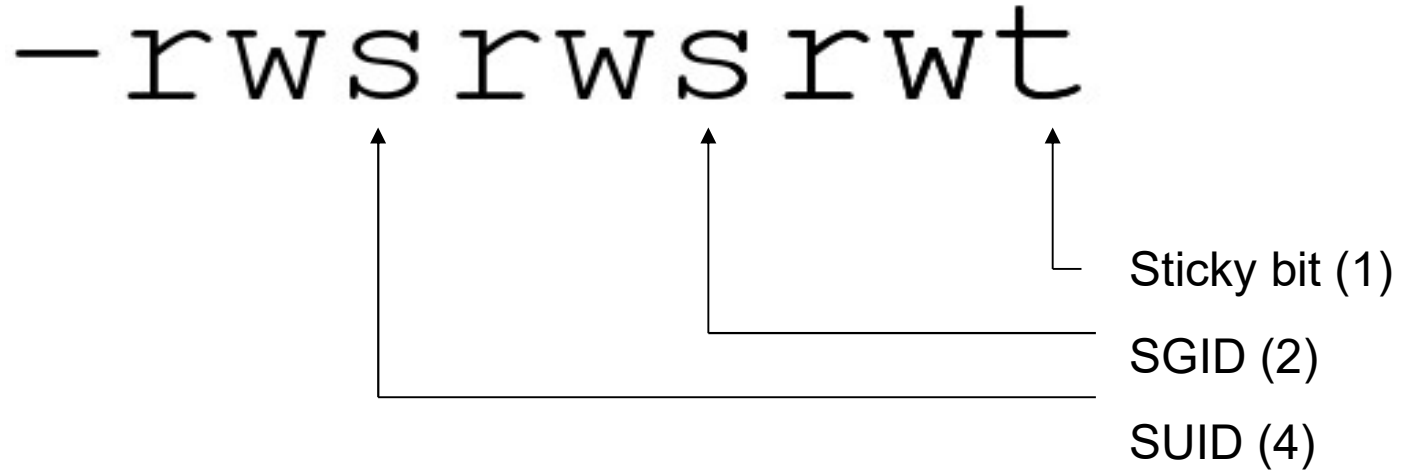
File Resultant Permissions

File Permissions \ Directory Permissions	-	r	x	wx
-	None	None	None	Delete file
r	None	None	Read data	Delete file Read data
w	None	None	Add/Delete data	Delete file Add/Delete data
rw	None	None	Update data	Delete file Update data
x	Can't execute	Can't execute	Execute	Delete file Execute

Permissions – Octal Equivalents

- Permissions can also be specified in 3 or 4 digit octal values
  - Read (r) = 4
  - Write (w) = 2
  - Exec (x) = 1
- Examples
  - -rwxrw-r-- = 764
  - -r-xr----- = 540

“Special” Permissions Illustration



- Examples
  - drwxrwxrwt = 1777
  - -rwsr-xr-x = 4755

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Passphrase Policy Recommendations

- Maximum Password Age: 60 days
- Minimum Password Age: 1 day
- Minimum Password Length: 15 characters
- Password History Length: 24 prior passwords
- Password Complexity
- Lockout Observation Window: 10 minutes
- Lockout Duration: 5 minutes
- Lockout Threshold: 5 failed attempts

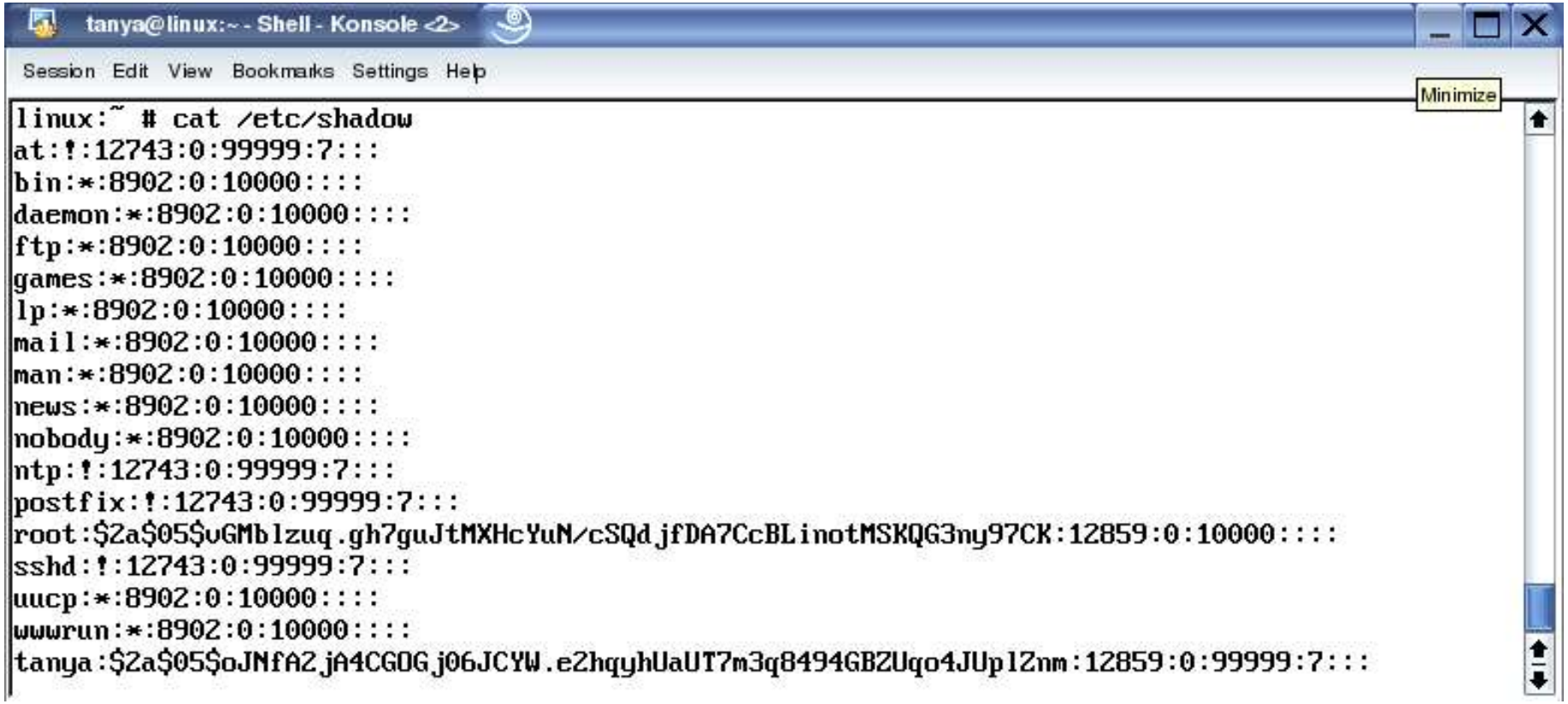
/etc/shadow

- Stores the encrypted passwords, as well as other information about passwords
  - Don’t use /etc/passwd to store encrypted passwords!
- Permissions on the /etc/shadow file should not allow normal users to read the file
  - 640 should apply to the file where the owner is root and the group is shadow, or similar

/etc/shadow Fields

- Contains 9 fields separated by a ":"
  - Username or User ID
  - Password in its encrypted format
    - All accounts should have a password, be locked out or removed
    - Fields starting with "!" or "*" means account is locked out
  - Number of days since Jan 1, 1970 that the password was last changed.
    - "=DATE(1970,1,1)-DATE(2005,6,30)" = 12,964
    - "=DATE(1970,1,1)+12964" = 6/30/2005
  - Minimum number of required days between password changes
  - Maximum number of days that a password is valid for
  - Number of days before expiring that the user starts to receive a warning message
  - Number of inactive days allowed for the user
  - Date after which the account can no longer be used
    - Number of days since January 1, 1970
  - Flag – not currently used

Sample /etc/shadow



PAM

- Pluggable Authentication Modules
  - Many modules exist
- Library and API that applications can use to authenticate users
- Can be used by many authentication systems
  - /etc/passwd, /etc/shadow, NIS, NIS+, LDAP, Kerberos, etc.
- Important files
  - PAM applications configured in /etc/pam.d or in /etc/pam.conf
  - Library modules normally stored in the directory /lib/security or /usr/lib/security
  - Configuration files are located in the directory /etc/security

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Centralized Patch Management

- Patches can be “pushed” out after they’ve been tested
  - Multiple groups can exist
- Patches should be prioritized

Patching UNIX

- Easy way for admin to manage source
  - Keep app source code on system and recompile when needed
  - Located at /usr/src or /usr/local/src
- Automated patch management tools do exist
  - autorpm, yast on-line update, apt-get, pkginfo, cron
- RCS, CVS, SCCS
  - Revision control systems
  - CVS allows anonymous client connections so used can “check out” the latest revisions
- You need to know what’s installed in order to keep a system patched!

Auditor Patching Tips

- Who submits changes?
- Who approves changes?
- Is there a patch management system?
- How are changes backed out if necessary?
- How are changes assigned to be completed?
- How is change integrity verified?
- How are changes tested?
- How are changes moved to the production environment?
- What's the emergency process?

*** Sample a few changes, as well as recent vulnerabilities.

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Typical UNIX Logs

- /var/log – typical log directory
- /var/run/utmp
  - Currently logged in users
  - Ephemeral in nature
  - Binary file
  - Log must be created
  - Contains: Username, terminal, login time, remote host
  - Commands: finger, who, w, users
- wtmp
  - Login-logout history
  - Binary file
  - Contains: Username, terminal, login time, logout time, remote host
  - Commands: finger, who, last

Typical UNIX Logs

- btmp
  - Bad login attempts
  - Binary file
  - Log must be created
  - Commands: lastb
- messages
  - Messages from the syslog facility
- secure
  - Access and authentication
- /var/adm/sulog
  - Logs use of the su command
  - /etc/default/su identifies the location of the log
- aculog
  - Dial-out modem log

Typical UNIX Logs

- lastlog
  - Logs each user's most recent login and possibly the last unsuccessful login
  - Command: lastlog
- loginlog
  - Bad login attempts
- /var/account/acct
  - Process-level accounting
  - Command: sa
- Extended audit capabilities are available
  - Can be specific to each Vendor and/or version of UNIX

Syslog.conf

- Syslog provides for log centralization
- Main configuration file for syslog
  - # lines are ignored
  - Each entry has the following
    - Facility
      - auth, authpriv, cron, daemon, kern, lpr, mail, mark, news, syslog, user, uucp, local0 through local7
      - Specifies the subsystem that produced the message
    - Priority
      - debug, info, notice, warning/warn, err/error, crit, alert, emerg/panic (same as emerg)
      - Defines the severity of the message
    - Action
      - Lists the log file location

Example syslog.conf

```
#; Critical system failures that management needs to see
*.err;*.crit;*.emerg                          /var/log/critical.log

#; Do not log auth/authpriv messages here; rather log them to
#; a separate file for processing by security staff.
auth,authpriv.none                            /var/log/messages
auth,authpriv.debug                           /var/log/auth.log
cron.info                                     /var/log/cron.log
news,kern,lpr,daemon,ftp,mail.info            /var/log/daemon.log

#; For more critical errors tell root. Ignore user messages.
*.err;user.none                               root
```

Logrotate

- Logs need to be managed
- Allows automatic rotation, compression, removal, and mailing of log files
- Each log file may be handled daily, weekly, monthly, or when it grows too large
- Normally, logrotate runs as a cron job

Auditor Log Tips

- Logs should be reviewed on a daily basis or according to policy
  - Unsuccessful user login attempts
  - Superuser access
  - System modifications
- Review what is being logged
- Centralized logging should be occurring
- Integrity checking tools should be used

Thank you!

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