LPIC-1 102-500 – Lesson 17

110.1 Perform security administration tasks

The SUID/SGID flags

- The **SUID** and **SGID** flags are used to give the right to normall users to execute a commands with the rights of another user or group.
- **-rwsr-xr-x 1 root root 90640 2011-08-09 19:16 /bin/mount** # the **/bin/mount** binary can be executed with **root** rights by any iuser in the system.
- **-rwxr-sr-x 1 root shadow 50760 2011-06-24 12:28 /usr/bin/chage** # the **/usr/bin/chage** binary can be executed with **shadow** group rights by any user in the system.
- **-rwsr-sr-x 1 daemon daemon 47848 2011-05-16 13:32 /usr/bin/at** # the **/usr/bin/at** binary can be executed with **daemon** user and group rights by all users.

Security concerns of SUID/SGID

- The presence of the **SUID/SGID** flags on binaries may be convinient but imposed very serious security risks if the command has some security vulnerability (e.g. buffer overflow).
- A vulnerable command can give the opportunity to an attacker to use it in away it was not purposed. Imagine for example if the **mount** command could call the **bash** shell! This would mean that **bash** would had the same rights of the SUID user of mount which is **root**!
- For this reason we need to check our system for SUID/SGID flags and avoid setting it to commands that can modify files or call the shell, like vi or emacs.

Find and remove SUID and SGID

- **# find / -perm -4000 -type f -ls** # check all normal files for the **SUID** flag, everywhere in the system.
- **# find / -perm -2000 -type f -ls** # check all normal files for the **SUID** flag, everywhere in the system.
- **# chmod u-s /bin/ping** # remove **SUID** from **/bin/ping**.
- **# chmod g-s /usr/bin/crontab** # remove **SGID** from # **/usr/bin/crontab**.
- **# chmod -s /usr/bin/at** # remove **SUID** and **SGID** from # **/usr/bin/at**.

The */etc/shadow* file

- The **/etc/shadow** file contains the hashed passwords of the users but also useful information about the expiry of passwords. The **/etc/shadow** fields are assigned the following roles:

- **user:6UwkipSFw$Jp3JxkKjZJ48zdM:15428:5:20:7:15:15695:**

1. Username
2. Hashed password (**!** or nothing: no password, *****: disabled account, **!<hash>**: locked account. **!!**: password not set).
3. Last change date
4. Minimum number of days where the user can change the password (**0** means the passwords can be changed any time).
5. Maximum number of days where the user can keep the same password (**99999** means no change required)
6. Number of days before the expirations where a warning will be issued.
7. Number of days (inactivity days) after the expiration where the account will be disabled.
8. Expiration Date (number of days after 01/01/1970).

Manage password expiry information with `chage`

- **# chage -l user1** # show expiry information for **user1**.
- **# chage -E 2012-12-21 user1** # set expiration date.
- **# chage -I 15 user1** # set inactivity days.
- **# chage -m 5 user1** # minimum days between password changes.
- **# chage -M 20 user1** # maximum days during which a password is valid.
- **# chage -W 6 user1** # warning days before expiration.
- **# chage -d 2012-03-25 user1** # set the last password change date.

Using `date` for showing change/expiry dates

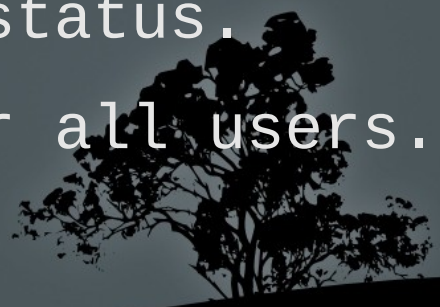
- **user:6UwkipSFw$Jp3JxkKjZJ48zdM:15428:5:20:7:15:15695:**
- `# date -d "1970/01/01 +15428 days"`
  `Thu Mar 29 00:00:00 EEST 2012 # last pass change date.`
- `# date -d "1970/01/01 +15695 days"`
  `Fri Dec 21 00:00:00 EET 2012 # password expiry date.`

These values can be used as parameters in the **chage** command to set days after 01/01/1970 (unix epoch).

- `# chage -d 15428 user # = chage -d 2012-03-29 user`
- `# chage -E 15695 user # = chage -E 2012-12-21 user`

Using `passwd` to manage expiry information

- **# passwd -i 15 user1** # set inactivity days.
- **# passwd -n 5 user1** # minimum days between password changes.
- **# passwd -x 20 user1** # maximum days during which a password is valid.
- **# passwd -w 6 user1** # warning days before expiration.
- **# passwd -e user1** # force password expiration and prompt for password change.
- **# passwd -S user1** # show **user1** status.
- **# passwd -Sa** # show statuses for all users.



Using `usermod` to manage expiry information

- `# usermod -e 2012-12-21 user # set expiration date.`
- `# usermod -f 15 user # set inactivity days.`
- `# usermod -L user # lock account.`
- `# usermod -U user # unlock account.`

Detect open ports on the system

- Ports on a system as used to provide access to applications “listening” to them.
- Sometimes system have pre-installed services the may not be needed.
- It is a good practice to disable unused services to save resources but most importantly to minimize the attack surface on a system. Attackers may use existing vulnerabilities in these services to penetrate the system.
- To check for open ports we can use the **ss**, **netstat**, **lsof** and **nmap** tools.

Check for open ports with `ss` and `netstat`

- The **ss** and **netstat** commands can be used to show the open ports on a system.
- `# ss -lnptu # show all listening tcp and udp ports in numeric format and the programs that use them.`
- `# netstat -lnptu # show all listening tcp and udp ports in numeric format and the programs that use them.`

Check for open ports with `lsof`

- The **lsof** command is used to display open files in the system. Sockets and ports are also considered files in a Linux system.
- `# lsof # show all open files in a system.`
- `# lsof -i # show all TCP/IP connections and ports.`
- `# lsof -iTCP -s:LISTEN -P # show all TCP listening ports in numeric form (-P).`
- `# lsof -iUDP | grep -v "\->" # show open UDP ports`
- `# lsof -p 6543 # show all open files of the 6543 process.`
- `# lsof -c apache2 # show open files of all apache2 processes.`
- `# lsof -u user1 # show all open files by user1.`
- `# lsof /mnt # show processes using the /mnt directory.`

Detect open ports with `nmap`

- Unlike the **ss, netstat** and **lsof** commands, **nmap** can detect open ports on other computers. In some countries its use is forbidden. It is a good practice to use it only on computers you own.
- **$ nmap sT www.network.dom** # (TCP Connect scan) default type of scan for non-privileged users.
- **# nmap -sS www.network.dom** # (TCP Syn scan) default type of scan for non-privileged users (faster).
- **# nmap -p 65-87,100 www.network.dom** # check ports 65 to 87 and 100 (TCP).
- **# nmap -p 1-65535 -O www.network.dom** # check all ports and detect operating system.
- **# nmap -sU -n www.network.dom** # UDP scan with numeric presentation.
- **# nmap -sP 10.0.0.0/24** # ping sweep to detect active nodes.
- **# nmap -sV 10.0.0.3** # detect services and versions behind open ports.

Switch users with `su`

- The **su** command is used to login into the system as another user. You have to use **the other user's password to login**. If no user is defined **root** is implied.

- **$ su** # login as **root** inheriting the environment of the original user.
- **$ su -** # login to the system as **root**. The environment will be the same as if we login directly as root (switch to the home directory, run **.bash_profile** or **.profile** etc).
- **$ su user1** # switch to **user1**
- **$ su - user1** # switch to **user1** in an environment same as **login**.
- **# su - user** # the root user can assume the role of any other system user without using a password!
- **$ su -c "find /etc"** # run the **find** command with **root** privileges.

Run commands as another user with `sudo`

- The **sudo** command is used to execute a command as another user but **using your own password**. For this to happen the user that needs **sudo** command execution rights must be declared in the **/etc/sudoers** or belongs to a group that is declared in said file.
- `$ sudo systemctl restart ssh # run command as root.`
- `$ sudo -u user1 mail # run command as user1.`
- `$ sudo -i # run a bash shell as root.`
- `$ sudo -b updatedb # run a background command as root.`

http://xkcd.com/149/

Configuring sudo with */etc/sudoers*

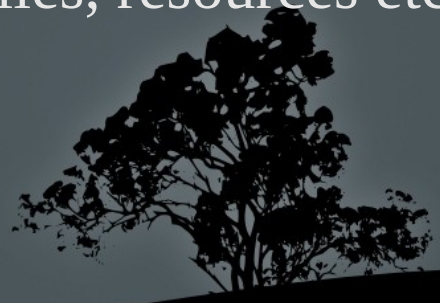
- In the **/etc/sudoers** file we declare all users or groups that have the right to use **sudo**. It's a read-only file so it is not recommended to be edited by any other text editor besides **visudo**.
- `# visudo # open /etc/sudoers for editing.`
- `user1  ALL=(ALL) ALL # give the right to user1 to run on any system, as any user χρήστης, any command.`
- `user1   mypc = (operator) /usr/bin/mount, /bin/kill, /usr/bin/lprm # give the right to user1 to run on mypc, as the operator user, the commands mount, kill and lprm.`

Configuring sudo with */etc/sudoers*

- **user1 server = (operator : operator) /usr/bin/mount, /bin/kill** # give the right to **user1** to execute on **server**, as user and group **operator**, the commands **mount** and **kill**.
- **user1 hostname = (operator) /usr/bin/mount, (root) /bin/kill** # give the right to **user1** to run as **operator** the command **mount** and as **root** the command **kill**.
- **user1 ALL = NOPASSWD: /bin/kill, PASSWD: /usr/bin/mount** # give the right to **user1** to run as **root**, the command **kill** without a password and the command **mount** using a password.
- **%admin ALL=(ALL) ALL** # assign all rights to the **admin** group.

Set limits with the */etc/security/limits.conf* file

- In the **/etc/security/limits.conf** file we define the limits for the different resources of the system.
- Its format is:
  <domain> <type> <item> <value>
- **domain**: **usename** (user1), **group** (@group1) or ***** (everybody)
- **type**: **soft** (soft limit), **hard** (hard limit), **–** (both). The soft limit can be exceeded by the users using the **ulimit** command while the hard limit can not.
- **item**: set the resource to limit e.g. **maxlogins**, **nproc**, **cpu**, memlock, etc.
- **value**: the limit value. It can be in kB for data resources, or minutes for time resources or even just a number of files, resources etc.



Set limits with the */etc/security/limits.conf* file

- Example items:
  - **maxlogins**: maximum sessions number.
  - **nproc**: number of processes.
  - **stack**: stack memory size.
  - **memlock**: locked memory size.
  - **as**: memory space size.
  - **cpu**: CPU usage time.
  - **fsize**: files size.
  - **nofiles**: number of files.

Set limits with the */etc/security/limits.conf* file

- Example of limits in **/etc/security/limit.conf**:

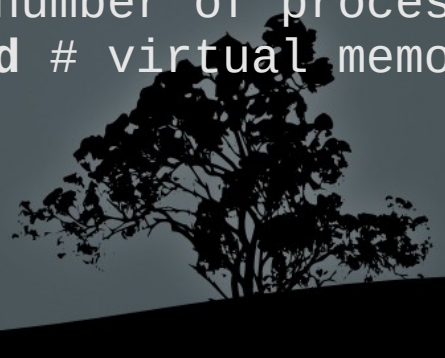
```
<domain>        <type>  <item>          <value>

*               hard    memlocks        10000
@student        hard    nproc           20
@faculty        soft    nproc           20
@faculty        hard    nproc           50
ftp             hard    nproc           0
@student        -       maxlogins       4
```

- The hard limit for **memlocks**, for all users is **10000 kB**.
- The hard limit for **nproc** for members of **student** is **20** processes.
- The soft and hard limit for **nproc**, for the members of the **faculty** group is 20 and 50 processes respectively.
- The **ftp** user has no right to execute processes.
- The members of the **student** group are allowed 4 sessions each.

Set user limits with `ulimit`

- The **ulimit** command s used to temporarily change the resources of the shell we are currently working with and all its child processes.
- Only the **root** user ac define limits and only the root can change its hard limit.
- Normal users can only redefine their own soft limit and it should not exceed the hard limit.

```
$ uname -a # = uname -Sa. Show soft limits
max locked memory       (kbytes, -l) 64 # locked memory
max memory size         (kbytes, -m) unlimited # resident memory
stack size              (kbytes, -s) 8192 # stack size
cpu time               (seconds, -t) unlimited # CPU time
max user processes              (-u) 30966 # number of processes
virtual memory          (kbytes, -v) unlimited # virtual memory
```



Set user limits with `ulimit`

- **$ ulimit -Ha** # show the user’s hard limits.
- **$ ulimit -u 45000** # increase the number of processes limit to 5000.
- **# ulimit -Hs 16384** # set the hard stack limit to 16MB.
- **$ ulimit -St 2** # set the soft cpu time limit to 2 minutes.
- **# ulimit -v 2048000000** # increase virtual memory limits (soft and hard) to 2GB.
- **$ ulimit -l 128** # increase the soft locked memory limit to 128kB.

The `who`, `w` and `last` commands

- **$ who** # show the logged in users and sessions.
- **$ w** # a better alternative to the **who**, showing user and sessions with more details.
- **$ last** # show the more recent logins, shutdowns and reboots.
- **# lastb** # show the more recent failed logins.

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