Linux Administration Notes

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1 File Management

1.1 File Permissions

File Permissions are used to prevent unauthorized access by *users* to files and directories

1.2 Permission Classes

Permission Classes unique cataegorizes utilized by the kernel to maintain file security via access rights.

Users are assigned to 3 catagories:

1. **User Owner (u)**
2. **Group (g)**
3. **Other (o)**
4. **All (a)** - represents all 3 classes

1.3 Permission Types

There are 3 types of permission bits:

1. **Read (r)** - view and copy
2. **Write (w)** - modify
3. **Execute (x)** - run
4. **null (-)** - permission not granted

1.4 Permission Modes

1. Append permission bit (+)
2. Revoke permission bit (-)
3. Assign permission bit (=)

1.5 Modifying Permissions

chmod is used to change permissions of files & diectories

1.5.1 Symbolic vs. Octal Notation

- **Symbolic Notation** uses letters (ex. **u,g,o**) & sumbols (ex. **+,-,=**) to modify permissions.
- **Octal Notation** uses 3-digit numbering (ex. **766**) to modify permissions.

1.6 Default Permission

umask is used to set default permissions on a file without modify permissions on existing files and directories.

- The default *umask* value for all users including the root user is **0022**.
- The default initial permission value for files is **666** & **777** for directories.

1.7 Calulating Default Permission

```
Calculating default permissions for files:
Initial Permission        666
umask                   - 022
==================
Default Permission         044

Calculating default permissions for directories:
Initial Permission        777
umask                   - 022
==================
Default Permission         055
```

1.8 Special File Permission

There are 3 Special Permission Bits that can be configured for binary files and directories:

1. **SETUID** (SET User IDentifier) - applied to binary executable files at the *user owner (u)* level. It gives non-owners the same file permissions as the user owner.
2. **SETGID** (SET Group IDentifier) - applied to binary executable files at the *user owner (u)* level. It gives non-owners and group memebers the same file permissions as the user & group owner.
3. **Sticky Bit** - is set on public directories to prevent other users from deleteing or moving files.

1.9 File Searching

find is the command used to search for files on a Linux System and perform actions on found files.

After invoking the find command, the first option is the location path to search (ex. current (.), /tmp, /home/).

1.10 `find` Command Options

- use **-iname** to search for files that *begins* with a string.

  example input: `find /dev -iname usb*`

  example output:
  ```
  /dev/usb1
  /dev/monusb0
  /dev/monusb1
  ```

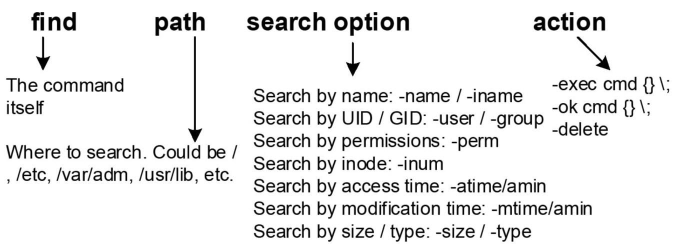

find
path
search option
action
The command itself
Where to search. Could be / , /etc, /var/adm, /usr/lib, etc.
Search by name: -name / -iname
Search by UID / GID: -user / -group
Search by permissions: -perm
Search by inode: -inum
Search by access time: -atime/amin
Search by modification time: -mtime/amin
Search by size / type: -size / -type
-exec cmd {} \;
-ok cmd {} \;
-delete

Figure 1: `find` Command Syntax

- use **-size** to search for files by size
  - use (-) to find items smaller then designated size
    example input: `find /dev -size -2M`
  - use (+) to find items larger then designated size
    example input: `find /dev -size +2M`
- find files owened by a specific user (*daemon*) and exclude specific group (*user1*).

  example input: `find /dev -user daemon -not -group user1`
- use **-type** to seach by filetype (d=directory, f=file)

  example input: `find /usr -type d -name src`
- use **-maxdepth** to seach set maximum subdirectory depth to search

  example input: `find /home -maxdepth 3 -type f -name src`

1.10.1 Using the `-exec` and `-ok` options

- `-exec` is used to perform actions on the files found by `find`.
- `-ok` is the same as `-exec`, but requires user confirmation to execute.

example input: `find /Documents -type f -name BLS* -exec ls -ld {} \;`

- (**{}**) represents each file found
- (**;**) terminates the command.
- (\\) is used to escape (**;**)

2 Linux Processes and Job Scheduling

2.1 Processes & Priorities

process a unit for provisioning system resources. It is any program, command, or application running on the system.

daemon critical system processes that startup automatically and run in the background.

- One parent process can spawn one or many child processes and passes attributes to them during creation (i.e., nice score).
- A *Process Identifacation Number (PID)* is assigned to each process.
- The PID is utilized by the kernel to manage the process during it's lifespan.

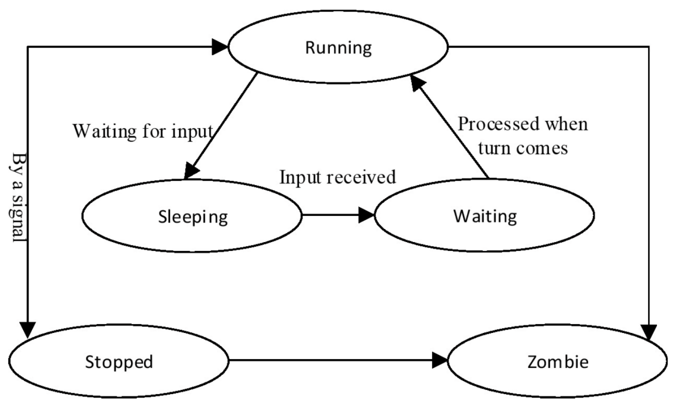


Figure 2: Process States

2.2 Process States

A process can jump from one operating state to another thoughout it's lifespan.
Every process is in one of the **5 Basic Operating States:**

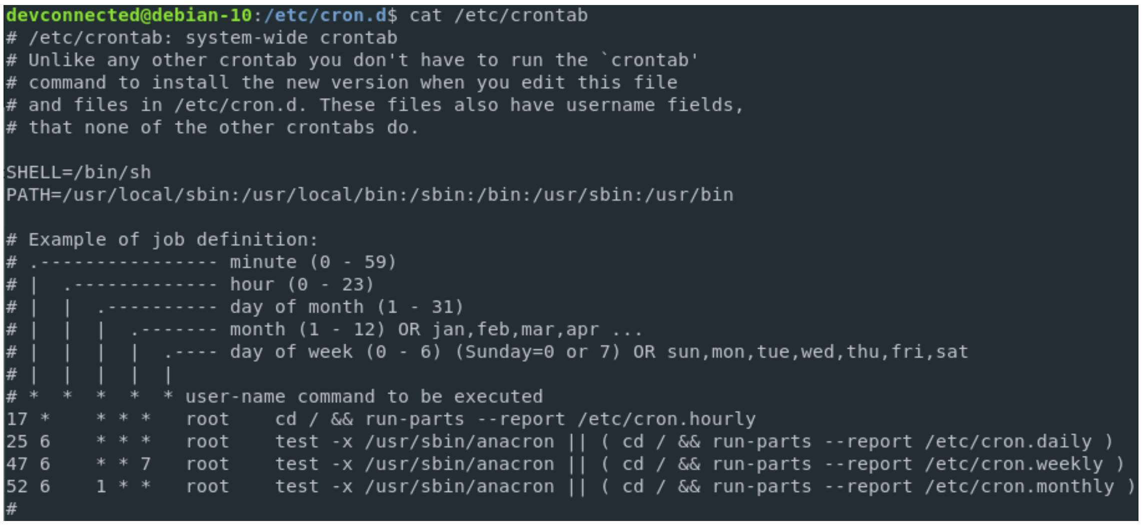
1. **running** - the process is currently being executed on the system.
2. **sleeping** - the process is waiting for input from the user or other source.
3. **waiting** - input has been recieved by the process and it is waiting to run.
4. **stopped** - the process has been halted and will not run until a signal is recieved to change it's state.
5. **zombie** - The process is *dead*, aka *defunt.* There is an entry in the process table, but the process takes up no reources (i.e, CPU).

2.3 Viewing and Monitoring System Processes using `ps` & `top`

- `ps` (process status)
  - Useful Commands & Options
    - `ps -as` output all processes and include file size.
    - pipe `ps` output to `grep` to filter output.
- `top` (table of processes)

2.4 Process Niceness & Priority

- the `nice` command can launch a program at a non-default priority.
  - nice can also be used to confirm default `nice` score on RHEL systems.
- the `renice` command is utilized to alter the priority of running processes.
- A process's execution priority is determined by the nice score assigned to it when it spawned. There are 40 niceness scores from *-20 (best)* to *19 (worst).*
- Higher Nice Score = More CPU Attention
- The default `nice` score for a process is `0`.
- Child process inherit the nice score of it's parent (calling) process.



```
devconnected@debian-10:/etc/cron.d$ cat /etc/crontab
# /etc/crontab: system-wide crontab
# Unlike any other crontab you don't have to run the `crontab'
# command to install the new version when you edit this file
# and files in /etc/cron.d. These files also have username fields,
# that none of the other crontabs do.

SHELL=/bin/sh
PATH=/usr/local/sbin:/usr/local/bin:/sbin:/bin:/usr/sbin:/usr/bin

# Example of job definition:
# .---------------- minute (0 - 59)
# |  .------------- hour (0 - 23)
# |  |  .---------- day of month (1 - 31)
# |  |  |  .------- month (1 - 12) OR jan,feb,mar,apr ...
# |  |  |  |  .---- day of week (0 - 6) (Sunday=0 or 7) OR sun,mon,tue,wed,thu,fri,sat
# |  |  |  |  |
# *  *  *  *  * user-name command to be executed
17 *    * * *   root    cd / && run-parts --report /etc/cron.hourly
25 6    * * *   root    test -x /usr/sbin/anacron || ( cd / && run-parts --report /etc/cron.daily )
47 6    * * 7   root    test -x /usr/sbin/anacron || ( cd / && run-parts --report /etc/cron.weekly )
52 6    1 * *   root    test -x /usr/sbin/anacron || ( cd / && run-parts --report /etc/cron.monthly )
#
```

Figure 3: `/etc/crontab` File

3 System Date and Time

timedatectl app used to get & change system timezone

3.1 View System Date & Time

- use `date` to view system date and time
- use `timedatectl` to view system timezone

3.2 Edit System Date & Time

- use `timedatectl set-timezone` to update system timezone
- edit `/etc/systemd/timesyncd.conf` file to update sytem NTP pools.

4 Job Scheduling

job scheduling allows users to run a command in the future.

atd is the service daemon used to schedule a one time task in the future.

atq app to view all scheduled jobs for current user.

crond is the service daemon used to schedule reptitive tasks.

- during system boot the crond daemon reads jobs from `/var/spool/cron/crontabs` (user cron jobs) & `/etc/cron.d` (system cron jobs).
- `crond` loads scheduled jobs into memory at boot and scans the files regularly thereafter.

crontab linux app used to edit the `/etc/contab` file.

4.1 Crontab Usage

crontab -e edit `/etc/crontab`

crontab -i view scheduled cronjobs

5 IPtables