



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 categorizes utilized by the kernel to maintain file security via access rights.

Users are assigned to 3 categories:

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 & directories

1.5.1 Symbolic vs. Octal Notation

- **Symbolic Notation** uses letters (ex. **u,g,o**) & symbols (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 Calculating 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 members the same file permissions as the user & group owner.
3. **Sticky Bit** - is set on public directories to prevent other users from deleting 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
```

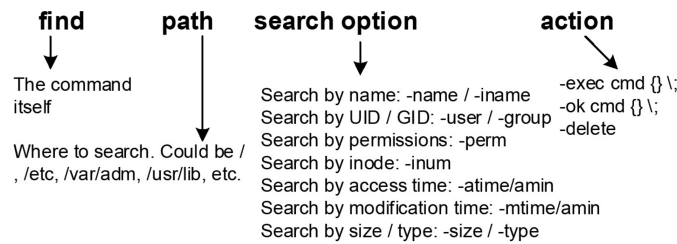


Figure 1: `find` Command Syntax

- 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 search 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.

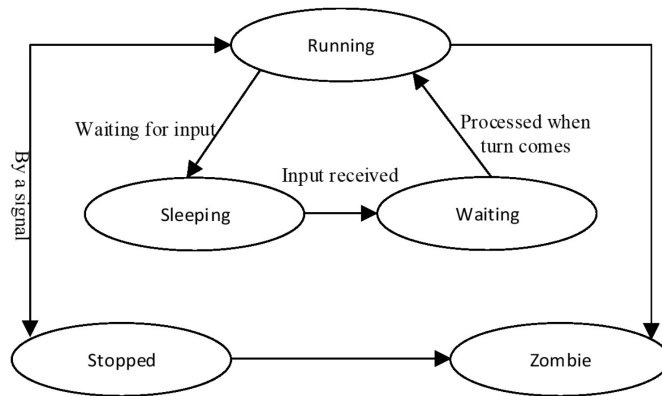


Figure 2: Process States

2.2 Process States

A process can jump from one operating state to another throughout its 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 received by the process and it is waiting to run.
4. **stopped** - the process has been halted and will not run until a signal is received to change its state.
5. **zombie** - The process is *dead*, aka *defunct*. There is an entry in the process table, but the process takes up no resources (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 its 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.

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

atq app to view all scheduled jobs for current user.

5 IPTables