

07 - Processes and Jobs

CS 2043: Unix Tools and Scripting, Spring 2016 [1]

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 - **They may also give very different results.**

Processes Overview

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- Not just a "running program", as you can execute the same program multiple times.
 - These would be multiple processes running an instance of the same program.
- Example: if you open more than one terminal (windows or tabs), you are running multiple processes of your shell.

Identification

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- The PID allows you to distinguish between multiple instances of the same program.
- There are countless ways to discover the PID, as well as what processes are running.
- These methods often depend on how much information you want, as well as what your user privileges are.

Identification: **ps**

Process Snapshot

ps [options]

- Reports a snapshot of the current running processes, including PIDs.
- By default, only the processes started by the user.
- **-e**: lists every process currently running on the system
- **-ely**: Gives more information than you can handle.
- **-u <username>**: lists all processes for user **username**.
- **Note**: very different for BSD/OSX, read the man page...
- To see more information about a process, pipe through **grep**.

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- To see more information about a process, pipe through **grep**.
- For example: **ps -e | grep firefox** shows us the results about **firefox** processes.

Identification: **ls**of

List of Open Files

lsof [options]

- Very similar to **ps**, with more information by default.
 - Frequently used for monitoring port connections...
 - **-i**: lists IP sockets
 - **ls**of **-i tcp:843** shows all tcp processes on port 843
 - Many options...read the man page if you are intrigued.
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- As with **ps**, often best served with a side of **grep**.

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- As with **ps**, often best served with a side of **grep**.
 - More useful for administration, especially when managing a networked environment.

Display and Update **top** CPU Processes

top [options]

- Displays the amount of resources in percentages each process is using.
 - **-d <seconds>**: control update frequency
 - The act of monitoring is an expensive process...
 - **-u <user>**: only show processes owned by **user**
 - **-p <PID>**: show statistics on process with id **PID** only.
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- When used in conjunction with **ps** or **lsuf**, can be a very powerful analysis tool.

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- When used in conjunction with **ps** or **lsuf**, can be a very powerful analysis tool.
 - **Example sequence on the next page.**

Example: Resource Monitoring

```
> ps -e | grep firefox
12975 ?        00:01:45 firefox
> top -p 12795
top - 09:37:56 up 1 day, 13:52,  5 users,  load average: 0.19, 0.20, 0.19
Tasks:  1 total,   0 running,   1 sleeping,   0 stopped,   0 zombie
%Cpu(s):  1.1 us,   0.5 sy,   0.0 ni, 98.4 id,   0.0 wa,   0.0 hi,   0.0 si,   0.0 st
KiB Mem : 16386660 total, 5990760 free, 3562320 used, 6833580 buff/cache
KiB Swap: 4194300 total, 4194300 free,      0 used. 12551476 avail Mem
  PID USER      PR  NI   VIRT   RES   SHR S  %CPU  %MEM     TIME+ COMMAND
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- Some great examples in [3].
 - I've found myself on that website *many* times, he has a lot of excellent examples about a large quantity of topics.

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> top -p 12795
top - 09:43:09 up 1 day, 13:57,  5 users,  load average: 1.33, 0.75, 0.41
Tasks:  1 total,   1 running,   0 sleeping,   0 stopped,   0 zombie
%Cpu(s): 13.4 us,  3.3 sy,  0.0 ni, 83.2 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
KiB Mem : 16386660 total, 3622768 free, 5679500 used, 7084392 buff/cache
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   PID USER      PR  NI  VIRT  RES  SHR S %CPU %MEM    TIME+  COMMAND
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- 75.7%?!?! Pretty common actually, this is why I always tell you to use your browser inside your Virtual Machine...

Modifying Processes

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- Can we tell the server to give your process less priority in terms of CPU time?
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- Quick switching back and forth between processes makes it seem as though they are all running simultaneously.

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- Can we tell the server to give your process less priority in terms of CPU time?
- Recall that although Unix seems to run tens or hundreds of processes at once, one CPE can only run one process at a time^{*}.
- Quick switching back and forth between processes makes it seem as though they are all running simultaneously.
- The Unix masters anticipated this need, and each process was given a **priority** when it starts.

Initial Priority

Start a process with a non-default priority:

The **nice** command

nice [options] command

- Runs **command** with a specified "*nice*ness" value (default: 10)
- *Nice*ness values range from **-20** (highest priority) to **19** (lowest priority)
- Only **root** can give a process a *negative nice*ness value
- Commands run without **nice** have priority 0.

Example

nice -n 10 deluge

- Keeps torrents from hogging the CPU.

Adjusting Priority

The **renice** command

```
renice <priority> -p <PID>
```

- Changes the *nice*ness of the process with id **PID** to **<priority>**
- Remember: only **root** can assign *negative* values.
- You can only **renice** a process you started.

Some Examples

```
renice 5 -p 10275
```

- Set the *nice*ness of the process with **PID 10275** to 5
 - Slightly lower than normal *nice*ness

```
renice 19 -u sven
```

- Set the *nice*ness of **all** my processes to 19

Ending Processes: I

Sometimes you need to end a process.

kill

```
kill [-signal] <PID>
```

- Sends the specified **signal** to the process with id **PID**
- By default, it terminates execution

killall

```
killall [-signal] <name>
```

- Kills processes by name.
- E.g. **killall firefox**

Note: These are dangerous commands, and should generally be last resorts.

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- Remember **top**? You can both *renice* and *kill* processes from within it!

Jobs

What are Jobs?

Jobs

A job is a process running *under the influence* of a job control facility.

- Job control is a built-in feature of most shells, allowing the user to pause and resume tasks.
- The user can also run them in the background.
- Not covered here: **crontab**. For the future sys admins, read the article in [2]

Why do you want this?

Let's use **ping** as an example.

Ping

`ping <server>`

- Measures network response time (latency) to a remote server.
- Sends short bursts to the server, then measures time until they return.

Example:

`ping google.com`

- Remember, **ctrl+c** kills the process.

Why we Need Job Control

As long as **ping** runs, we lose control of our shell. This happens with many other applications.

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Example:

```
vlc
```

Starting a Job in the Background

To run a job in the background, we will use a new operator:

&

`<command> [arguments] &`

- Runs the specified command as a background job.
- Unless told otherwise, will send output to the terminal!
- But at least we can type in our terminal again.

Example:

```
vlc best_song_ever.flac &
```

Sending a Job to the Background

If you already started the job, but don't want to wait any more:

Pausing a Job

Press `ctrl+z` to pause a running process!

- Note this is still `ctrl` even on Mac...just like `ctrl+c`

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- Note this is still `ctrl` even on Mac...just like `ctrl+c`
- The shell will pause the jobs **JOB ID** (similar to **PID**)
- We can bring it back.

Revivals

Background

`bg <JOB ID>`

- Resumes the job with id **JOB ID** in the *background*
- Without **JOB ID**, resumes last job placed in background.

Foreground

`fg <JOB ID>`

- Resumes the job with id **JOB ID** in the *foreground*.
- Without **JOB ID**, resumes last job placed in background.

Discovering your **jobs**

`jobs`

- Prints the running, paused, or recently stopped jobs.
- Prints jobs with their **JOB IDs**.

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ping google.com > testping.log &
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- Ignoring the output:

Ignoring it all

```
vlc best_song_ever.flac -- &> /dev/null &
```


Job Control Demo

I did a demo on-the-fly in class demonstrating job control, pausing, resuming, etc. I encourage you to follow the *ex post facto* demo here:

<https://github.com/cs2043-sp16/lecture-demos/tree/master/lec07>

References I

- [1] B. Abrahao, H. Abu-Libdeh, N. Savva, D. Slater, and others over the years.

Previous cornell cs 2043 course slides.

- [2] C. Hope.

Linux and unix crontab command help and examples.

[http:](http://www.computerhope.com/unix/ucrontab.htm)

[//www.computerhope.com/unix/ucrontab.htm](http://www.computerhope.com/unix/ucrontab.htm).

- [3] R. Natarajan.

Can you top this? 15 practical linux top command examples.

[http://www.thegeekstuff.com/2010/01/](http://www.thegeekstuff.com/2010/01/15-practical-unix-linux-top-command-examples/)

[15-practical-unix-linux-top-command-examples/](http://www.thegeekstuff.com/2010/01/15-practical-unix-linux-top-command-examples/).

