

1. ps aux Explanation: a → show processes for all users u → show user/owner of process x → show processes not attached to a terminal Example Output: USER PID %CPU %MEM VSZ RSS TT STAT START TIME COMMAND

```
START TIME COMMAND
root 1 0.0 0.1 167500 1100 ? Ss Sep25 0:05 /sbin/initvibhu 1234 1.2 1.5 274532
15632 ? SI 10:15 0:12 /usr/bin/python3 script.pymysql 2001 0.5 2.0 450000 20988 ? Ssl Sep25 1:02
/usr/sbin/mysqld
```

USER	PID	%CPU	%MEM	VSZ	RSS	TT	STAT	STARTED	TIME	COMMAND
vaibhavkumar	6644	99.6	0.3	507371616	52736	??	Rs	6:54PM	49:23.92	/System/Library/_windowserver
vaibhavkumar	3245	36.0	2.5	441652368	422608	??	Ss	Tue08AM	238:39.08	/System/Library/_coreaudiod
vaibhavkumar	585	17.0	0.8	437248168	129712	??	Ss	Mon06PM	130:09.88	/System/Library/_windowserver
vaibhavkumar	7378	13.3	13.5	518562112	2267568	??	Ss	9:59AM	2:35.46	/System/Library/_driverkit
root	545	7.9	0.1	435486128	71184	??	Ss	Mon06PM	76:27.46	/usr/sbin/coreau
vaibhavkumar	938	3.7	0.8	435434544	83072	??	Ss	Mon06PM	1:15.71	/System/Library/_opene
vaibhavkumar	3244	2.5	0.5	440403369	82772	??	Ss	Tue08AM	14:43.34	/System/Library/_neuralengine
vaibhavkumar	6385	2.3	2.0	436391928	323894	??	S	3:52PM	5:19.33	/Applications/Wh
vaibhavkumar	3240	1.2	1.5	444127562	258488	??	S	Tue08AM	14:56.86	/System/Volumes/_
root	498	0.9	0.3	435387288	44864	??	Ss	Mon06PM	15:48.88	/System/Library/_
root	506	0.6	0.3	435531608	51584	??	Ss	Mon06PM	4:05.02	/usr/libexec/log
vaibhavkumar	1127	0.5	0.5	435438224	83870	??	Ss	Mon06PM	10:16.25	/usr/libexec/due
root	577	0.3	0.6	435328576	4888	??	Ss	Mon06PM	0:03.66	/usr/libexec/log
root	4956	0.3	0.2	435373312	30864	??	Ss	Tue09PM	3:47.78	/usr/libexec/Per
vaibhavkumar	1499	0.2	0.8	436026928	128976	??	S	Mon06PM	4:28.14	/System/Library/_modelanagerd
vaibhavkumar	1458	0.2	0.2	435526304	26648	??	S	Mon06PM	0:17.30	/System/Library/_
root	1	0.1	0.1	435245648	21984	??	Ss	Mon06PM	8:56.05	/sbin/launched
vaibhavkumar	881	0.1	0.1	435359648	18929	??	Ss	Mon06PM	1:27.55	/System/Library/_
vaibhavkumar	6321	0.1	0.1	435321972	121892	??	S	Mon06PM	0:01.00	/System/Library/_
root	570	0.1	0.6	435359292	4940	??	Ss	Mon06PM	0:34.53	/usr/sbin/identity
root	573	0.1	0.1	435359292	14974	??	Ss	Mon06PM	3:55.78	/usr/libexec/cor
vaibhavkumar	6367	0.0	0.1	435385296	18394	??	Ss	3:47PM	0:09.21	/System/Library/_
vaibhavkumar	6366	0.0	0.4	435581369	71824	??	Ss	3:47PM	0:01.74	/System/Library/_
vaibhavkumar	6365	0.0	0.6	435321568	3584	??	Ss	3:47PM	0:00.84	/usr/libexec/ptp
vaibhavkumar	6364	0.0	0.0	435301296	3536	??	Ss	3:47PM	0:00.01	/System/Library/_
vaibhavkumar	6361	0.0	0.0	435305008	3280	??	Ss	3:47PM	0:00.02	/System/Library/_
vaibhavkumar	6368	0.0	0.0	435357008	4288	??	Ss	3:47PM	0:00.00	/System/Library/_
vaibhavkumar	6359	0.0	0.0	435383376	2016	??	Ss	3:47PM	0:00.00	/System/Library/_
vaibhavkumar	6358	0.0	0.5	436274912	91424	??	Ss	3:47PM	0:05.92	/System/Applicat
vaibhavkumar	6331	0.0	0.3	435646496	42352	??	Ss	3:37PM	0:00.65	/System/Library/_
vaibhavkumar	6323	0.0	0.0	435357008	3895	s000	S	3:37PM	0:00.00	-z-
root	6320	0.0	0.0	435308976	7048	s000	Ss	3:37PM	0:00.00	login -pf vaibha
vaibhavkumar	6289	0.0	0.1	1714314689	76956	??	S	3:34PM	0:00.35	/Applications/Go
vaibhavkumar	6288	0.0	0.0	435365552	4048	??	Ss	3:34PM	0:00.06	/System/Library/_
vaibhavkumar	6284	0.0	1.3	1716336898	214880	??	S	3:34PM	0:23.31	/Applications/Go
vaibhavkumar	6282	0.0	0.7	1714421248	123376	??	S	3:34PM	0:00.50	/Applications/Go
vaibhavkumar	6289	0.0	0.2	435452032	38896	??	Ss	3:34PM	0:03.33	/System/Library/_
vaibhavkumar	6269	0.0	0.4	469279264	63872	??	S	3:34PM	0:01.80	/Applications/Go
vaibhavkumar	6257	0.0	0.6	469345584	95632	??	S	3:34PM	0:06.73	/Applications/Go
vaibhavkumar	6256	0.0	0.6	469509562	99488	??	S	3:34PM	0:12.80	/Applications/Go
vaibhavkumar	6253	0.0	0.8	469841792	7504	??	S	3:34PM	0:00.00	/Applications/Go
vaibhavkumar	6249	0.0	1.5	503485752	253888	??	S	3:34PM	0:38.79	/Applications/Go
vaibhavkumar	6202	0.0	0.0	435355456	7968	??	S	3:04PM	0:00.22	/System/Library/_
vaibhavkumar	5944	0.0	0.3	435623664	54832	??	Ss	1:07PM	0:01.81	/System/Library/_
vaibhavkumar	6231	0.0	0.0	435359008	99864	??	Ss	3:07PM	0:00.00	login -pf vaibha
vaibhavkumar	6230	0.0	0.2	435694384	16672	??	Ss	3:07PM	0:00.00	/System/Library/_
root	6051	0.0	0.0	435321888	3104	??	Ss	Tue10PM	0:00.00	/System/Library/_
vaibhavkumar	4793	0.0	0.0	435317288	2014	??	Ss	Tue09PM	0:00.02	/System/Library/_
vaibhavkumar	4781	0.0	0.1	435378544	9294	??	Ss	Tue09PM	0:00.11	/usr/libexec/fsk
root	4662	0.0	0.6	435354992	6768	??	Ss	Tue09PM	0:03.82	/Library/Apple/S
vaibhavkumar	4592	0.0	0.0	435355664	6832	??	Ss	Tue09PM	0:03.70	/Library/Apple/S
vaibhavkumar	4599	0.0	0.1	435362464	22176	??	Ss	Tue09PM	0:00.40	/System/iOSSuppo
vaibhavkumar	4517	0.0	0.1	435321768	8968	??	Ss	Tue09PM	0:00.14	/System/Library/_
vaibhavkumar	4516	0.0	0.1	435484648	8768	??	Ss	Tue09PM	0:00.13	/System/Library/_
vaibhavkumar	4515	0.0	0.0	435383120	1952	??	Ss	Tue09PM	0:00.02	/System/Library/_
vaibhavkumar	4498	0.0	0.1	411463552	9288	??	Ss	Tue09PM	0:18.41	/System/Library/_
vaibhavkumar	4488	0.0	0.2	435375968	26488	??	Ss	Tue08PM	0:15.32	/System/Library/_
_neuralengine	4467	0.0	0.6	435321608	1984	??	S	Tue08PM	0:00.87	/usr/sbin/cpref
_modelanagerd	4464	0.0	0.6	435321712	1952	??	S	Tue08PM	0:00.86	/usr/sbin/cpref
root	4383	0.0	0.0	435321216	2112	??	Ss	Tue08PM	0:00.88	/System/Library/_
vaibhavkumar	4378	0.0	0.0	435356208	4224	??	Ss	Tue08PM	0:00.13	/System/Library/_

2. Process Tree Command: pstree -p Example Output: systemd(1)——NetworkManager(778)
 └—sshd(895)——sshd(1023)——bash(1024)——pstree(1101) └—mysqld(2001)
 └—python3(1234) 👉 Shows parent-child process relationships.

⚡ 4. Adjust Process Priority Start a process with low priority: nice -n 10 sleep 300 & Output: [1] 3050 ↩
 PID = 3050 is running in background with nice value 10. Change priority of running process: renice -n -5 -p 3050 Output: 3050 (process ID) old priority 10, new priority -5 ↩ Now process runs with higher priority.

```
vaibhavkumar@VAIBHAVs-MacBook-Air ~ %
[vaibhavkumar@VAIBHAVs-MacBook-Air ~ % nice -n 10 sleep 300 &
[1] 13249
vaibhavkumar@VAIBHAVs-MacBook-Air ~ %
```

```
vaibhavkumar@VAIBHAVs-MacBook-Air ~ % nice -n 10 sleep 300 &
[1] 13295
vaibhavkumar@VAIBHAVs-MacBook-Air ~ % sudo renice -n -5 -p 13295
vaibhavkumar@VAIBHAVs-MacBook-Air ~ % ps -o pid,ni,comm -p 13295
```

```
PID NI COMM
13295 10 sleep
vaibhavkumar@VAIBHAVs-MacBook-Air ~ %
```

🔧 5. CPU Affinity (Bind Process to CPU Core) Command: taskset -cp 3050 Example Output: pid 3050's current affinity list: 0-3 ↩ Shows process is allowed on cores 0,1,2,3. Restrict to core 1 only: taskset -cp 1 3050 Output: pid 3050's current affinity list: 1

📝 6. I/O Scheduling Priority Command: ionice -c 3 -p 3050 Output: successfully set pid 3050's IO scheduling class to idle ↩ Class 3 (idle) → Process only gets I/O when system is idle.

📝 7. File Descriptors Used by a Process Command: lsof -p 3050 | head -5 Example Output: COMMAND PID USER FD TYPE DEVICE SIZE/OFF NODE NAME
 sleep 3050 vibhu cwd DIR 253,0 4096 131073 /home/vibhusleep 3050 vibhu rtd DIR 253,0 4096 2 / sleep 3050 vibhu txt REG 253,0 17520 133580 /usr/bin/sleep

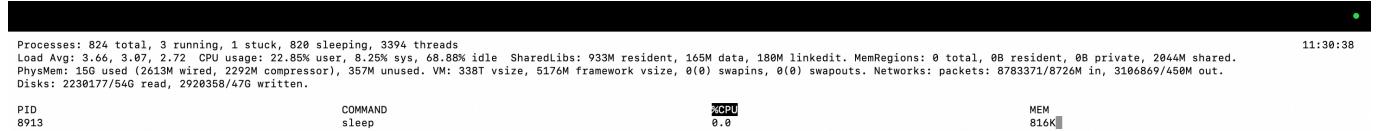
```
[vaibhavkumar@VAIBHAVs-MacBook-Air ~ % nice -n 10 sleep 300 &
[1] 13357
[vaibhavkumar@VAIBHAVs-MacBook-Air ~ % lsof -p 13357 | head -5
```

COMMAND	PID	USER	FD	TYPE	DEVICE	SIZE/OFF	NODE	NAME
sleep	13357	vaibhavkumar	cwd	DIR	1,18	4224	263104	/Users/vaibhavkumar
sleep	13357	vaibhavkumar	txt	REG	1,18	101168	1152921500312554158	/bin/sleep
sleep	13357	vaibhavkumar	txt	REG	1,18	2299264	1152921500312555984	/usr/lib/dyld
sleep	13357	vaibhavkumar	0u	CHR	16,4	0t131478	747	/dev/ttys004

🐛 8. Trace System Calls of a Process Command: strace -p 3050 Example Output: strace: Process 3050 attached
 restart_syscall(<... resuming interrupted nanosleep ...>) = 0nanosleep({tv_sec=300, tv_nsec=0}, 0x7ffd4a60d8b0) = ? ERESTART_RESTARTBLOCK (Interrupted by signal) ↩ Great for debugging.

📡 9. Find Process Using a Port Command: sudo fuser -n tcp 8080 Output: 8080/tcp: 4321 ↩ PID 4321 is using port 8080.

10. Per-Process Statistics Command: pidstat -p 3050 2 3 Example Output: Linux 5.15.0 (ubuntu)
 09/25/25 x86_64 (4 CPU) 12:30:20 UID PID %usr %system %CPU CPU Command
 12:30:22 1000 3050 0.00 0.00 0.00 1 sleep
 12:30:24 1000 3050 0.00 0.00 0.00 1 sleep
 12:30:26 1000 3050 0.00 0.00 0.00 1 sleep
- 👉 Shows CPU usage every 2 seconds, 3 times.



```

Processes: 824 total, 3 running, 1 stuck, 820 sleeping, 3394 threads
Load Avg: 3.66, 3.07, 2.72 CPU usage: 22.85% user, 8.25% sys, 68.88% idle SharedLibs: 933M resident, 165M data, 180M linkedit. MemRegions: 0 total, 0B resident, 0B private, 2044M shared.
PhysMem: 15G used (2613M wired, 2292M compressor), 357M unused. VM: 338T vsize, 5176M framework vsize, 0(0) swapins, 0(0) swapouts. Networks: packets: 8783371/8726M in, 3106869/450M out.
Disks: 2230177/540 read, 2920358/47G written.

PID      COMMAND    %CPU    MEM
8913     sleep      0.0     816K

```

11. Control Groups (cgroups) for Resource Limits Create a new cgroup: sudo cgcreate -g cpu,memory:/testgroup Limit CPU and Memory: echo 50000 | sudo tee /sys/fs/cgroup/cpu/testgroup/cpu.cfs_quota_us | echo 100M | sudo tee /sys/fs/cgroup/memory/testgroup/memory.limit_in_bytes Add a process (PID 3050) to cgroup: echo 3050 | sudo tee /sys/fs/cgroup/cpu/testgroup/cgroup.procs

```

[vaihbavkumar@VAIBHAVs-MacBook-Air ~ % sudo cpulimit -p <14173> -l 50 # Limit to 50% CPU
zsh: no such file or directory: 14173
[vaihbavkumar@VAIBHAVs-MacBook-Air ~ % sudo cpulimit -p 14173 -l 50 # Limit to 50% CPU
[
Error: You must specify exactly one target process, either by name, pid, or command line
Usage: cpulimit [OPTIONS...] TARGET
OPTIONS
  -l, --limit=N          percentage of cpu allowed from 0 to 1000 (required)
  -v, --verbose          show control statistics
  -z, --lazy             exit if there is no target process, or if it dies
  -i, --include-children limit also the children processes
  -h, --help              display this help and exit
TARGET must be exactly one of these:
  -p, --pid=N            pid of the process (implies -z)
  -e, --exe=FILE          name of the executable program file or path name
  COMMAND [ARGS]         run this command and limit it (implies -z)

```

Report bugs to <marlonx80@hotmail.com>.
 vaihbavkumar@VAIBHAVs-MacBook-Air ~ % ulimit -v 1048576