An lsof Primer

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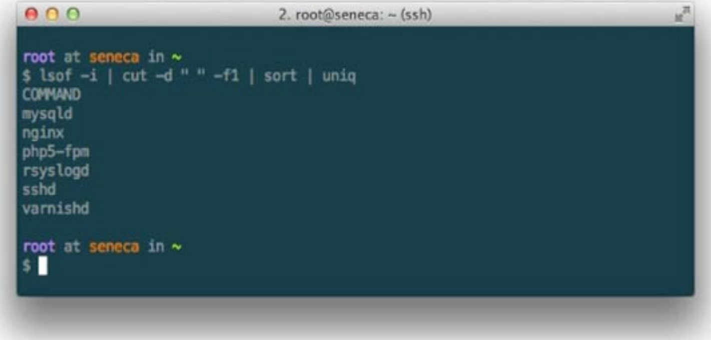

```
root at seneca in ~
$ lsof -i | cut -d " " -f1 | sort | uniq
COMMAND
mysqld
nginx
php5-fpm
rsyslogd
sshd
varnishd

root at seneca in ~
$ 
```

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Key Options

Getting Information About the Network

User Information

Commands and Processes

Files and Directories

Advanced

`lsof` is the sysadmin/security über-tool. I use it most for getting network connection related information from a system, but that's just the beginning for this powerful and too-little-known application. The tool is aptly called lsof because it "**lists open files**". And remember, in UNIX just about everything (including a network socket) is a file.

Interestingly, `lsof` is also the Linux/Unix command with the most switches. It has so many it has to use both minuses *and* pluses.

```
usage: [-?abhlnNoOPRstUvV] [+|-c c] [+|-d s] [+D D] [+|-f[cgG]]
 [-F [f]] [-g [s]] [-i [i]] [+|-L [l]] [+|-M] [-o [o]]
 [-p s] [+|-r [t]] [-S [t]] [-T [t]] [-u s] [+|-w] [-x [fl]] [--] [names]
```

As you can see, `lsof` has a truly staggering number of options. You can use it to get information about devices on your system, what a given user is touching at any given point, or even what files or network connectivity a process is using.

For me, `lsof` replaces both `netstat` and `ps`entirely. It has everything I get from those tools and much, much more. So let's look at some of its primary capabilities:

KEY OPTIONS

It's important to understand a few key things about how `lsof` works. Most importantly, when you're passing options to it, the default behavior is to OR the results. So if you are pulling a list of ports with `-i` and also a process list with `-p` you're by default going to get both results.

Here are a few others like that to keep in mind:

- **default** : without options, `lsof` lists all open files for active processes
- **grouping** : it's possible to group options, e.g. `-abC`, but you have to watch for which options take parameters
- `-a` : AND the results (instead of OR)
- `-l` : show the userID instead of the username in the output
- `-h` : get help
- `-t` : get process IDs only
- `-U` : get the UNIX socket address
- `-F` : the output is ready for another command, which can be formatted in various ways, e.g. -F pcfn (for process id, command name, file descriptor, and file name, with a null terminator)

GETTING INFORMATION ABOUT THE NETWORK

As I said, one of my main usecases for `lsof` is getting information about how my system is interacting with the network. Here are some staples for getting this info:

SHOW ALL CONNECTIONS WITH `-I`

Some like to use `netstat` to get network connections, but I much prefer using `lsof` for this. The display shows things in a format that's intuitive to me, and I like knowing that from there I can simply change my syntax and get more information using the same command.

```
# lsof -i
```

```
COMMAND  PID USER   FD   TYPE DEVICE SIZE NODE NAME
dhcpcd 6061 root 4u IPv4 4510 UDP *:bootpc
sshd 7703 root 3u IPv6  6499 TCP *:ssh (LISTEN)
sshd 7892 root 3u IPv6  6757 TCP 10.10.1.5:ssh->192.168.1.5:49901 (ESTABLISHED
```

GET ONLY IPV6 TRAFFIC WITH `-I 6`

```
# lsof -i 6
```

SHOW ONLY TCP CONNECTIONS (WORKS THE SAME FOR UDP)

You can also show only TCP or UDP connections by providing the protocol right after the `-i`.

```
# lsof -iTCP
```

```
COMMAND  PID USER   FD   TYPE DEVICE SIZE NODE NAME
sshd 7703 root 3u IPv6 6499 TCP *:ssh (LISTEN)
sshd 7892 root 3u IPv6 6757 TCP 10.10.1.5:ssh->192.168.1.5:49901 (ESTABLISHED)
```

SHOW NETWORKING RELATED TO A GIVEN PORT USING `-I :PORT`

Or you can search by port instead, which is great for figuring out what's preventing another app from binding to a given port.

```
# lsof -i :22
```

```
COMMAND  PID USER   FD   TYPE DEVICE SIZE NODE NAME
sshd 7703 root 3u  IPv6 6499 TCP *:ssh (LISTEN)
sshd 7892 root 3u  IPv6 6757 TCP 10.10.1.5:ssh->192.168.1.5:49901 (ESTABLISHED
```

SHOW CONNECTIONS TO A SPECIFIC HOST USING `@HOST`

This is quite useful when you're looking into whether you have open connections with a given host on the network or on the internet.

```
# lsof -i@172.16.12.5
```

```
sshd 7892 root 3u IPv6 6757 TCP 10.10.1.5:ssh->172.16.12.5:49901 (ESTABLISHED)
```

SHOW CONNECTIONS BASED ON THE HOST AND THE PORT USING `@HOST:PORT`

You can also combine the display of host and port.

```
# lsof -i@172.16.12.5:22
```

```
sshd 7892 root 3u IPv6 6757 TCP 10.10.1.5:ssh->192.168.1.5:49901 (ESTABLISHED)
```

FIND LISTENING PORTS

Find ports that are awaiting connections.

```
# lsof -i -sTCP:LISTEN
```

You can also do this by grepping for “LISTEN” as well.

```
# lsof -i | grep -i LISTEN
```

```
iTunes     400 daniel   16u  IPv4 0x4575228  0t0 TCP *:daap (LISTEN)
```

FIND ESTABLISHED CONNECTIONS

You can also show any connections that are already pinned up.

```
# lsof -i -sTCP:ESTABLISHED
```

You can also do this just by searching for “ESTABLISHED” in the output via `grep`.

```
# lsof -i | grep -i ESTABLISHED
```

```
firefox-b 169 daniel  49u IPv4 0t0 TCP 1.2.3.3:1863->1.2.3.4:http (ESTABLISHED
```

USER INFORMATION

You can also get information on various users and what they're doing on the system, including their activity on the network, their interactions with files, etc.

SHOW WHAT A GIVEN USER HAS OPEN USING -U

```
# lsof -u daniel
```

```
-- snipped --
Dock 155 daniel  txt REG   14,2   2798436   823208 /usr/lib/libicucore.A.dylib
Dock 155 daniel  txt REG   14,2   1580212   823126 /usr/lib/libobjc.A.dylib
Dock 155 daniel  txt REG   14,2   2934184   823498 /usr/lib/libstdc++.6.0.4.dy
Dock 155 daniel  txt REG   14,2    132008   823505 /usr/lib/libgcc_s.1.dylib
Dock 155 daniel  txt REG   14,2    212160   823214 /usr/lib/libauto.dylib
-- snipped --
```

SHOW WHAT ALL USERS ARE DOING EXCEPT A CERTAIN USER USING -U ^USER

```
# lsof -u ^daniel
```

```
-- snipped --
Dock 155 jim  txt REG   14,2   2798436   823208 /usr/lib/libicucore.A.dylib
Dock 155 jim  txt REG   14,2   1580212   823126 /usr/lib/libobjc.A.dylib
Dock 155 jim  txt REG   14,2   2934184   823498 /usr/lib/libstdc++.6.0.4.dylib
Dock 155 jim  txt REG   14,2    132008   823505 /usr/lib/libgcc_s.1.dylib
Dock 155 jim  txt REG   14,2    212160   823214 /usr/lib/libauto.dylib
-- snipped --
```

KILL EVERYTHING A GIVEN USER IS DOING

It's nice to be able to nuke everything being run by a given user.

```
# kill -9 `lsof -t -u daniel`
```

COMMANDS AND PROCESSES

It’s often useful to be able to see what a given program or process is up to, and with `lsof` you can do this by name or by process ID. Here are a few options:

SEE WHAT FILES AND NETWORK CONNECTIONS A NAMED COMMAND IS USING WITH `-C`

```
# lsof -c syslog-ng
```

```
COMMAND    PID USER   FD   TYPE     DEVICE    SIZE       NODE NAME
syslog-ng 7547 root  cwd    DIR    3,3    4096   2 /
syslog-ng 7547 root  rtd    DIR    3,3    4096   2 /
syslog-ng 7547 root  txt    REG    3,3  113524  1064970 /usr/sbin/syslog-ng
-- snipped --
```

SEE WHAT A GIVEN PROCESS ID HAS OPEN USING `-P`

```
# lsof -p 10075
```

```
-- snipped --
sshd    10068 root  mem    REG    3,3   34808 850407 /lib/libnss_files-2.4.so
sshd    10068 root  mem    REG    3,3   34924 850409 /lib/libnss_nis-2.4.so
sshd    10068 root  mem    REG    3,3   26596 850405 /lib/libnss_compat-2.4.so
sshd    10068 root  mem    REG    3,3  200152 509940 /usr/lib/libssl.so.0.9.7
sshd    10068 root  mem    REG    3,3   46216 510014 /usr/lib/liblber-2.3
sshd    10068 root  mem    REG    3,3   59868 850413 /lib/libresolv-2.4.so
sshd    10068 root  mem    REG    3,3 1197180 850396 /lib/libc-2.4.so
sshd    10068 root  mem    REG    3,3   22168 850398 /lib/libcrypt-2.4.so
sshd    10068 root  mem    REG    3,3   72784 850404 /lib/libnsl-2.4.so
sshd    10068 root  mem    REG    3,3   70632 850417 /lib/libz.so.1.2.3
sshd    10068 root  mem    REG    3,3    9992 850416 /lib/libutil-2.4.so
-- snipped --
```

THE `-T` OPTION RETURNS JUST A PID

```
# lsof -t -c Mail
```

```
350
```

FILES AND DIRECTORIES

By looking at a given file or directory you can see what all on the system is interacting with it–including users, processes, etc.

SHOW EVERYTHING INTERACTING WITH A GIVEN DIRECTORY

```
# lsof /var/log/messages/
```

```
COMMAND     PID USER   FD   TYPE DEVICE   SIZE   NODE NAME
syslog-ng 7547 root    4w   REG     3,3 217309 834024 /var/log/messages
```

SHOW EVERYTHING INTERACTING WITH A GIVEN FILE

```
# lsof /home/daniel/firewall_whitelist.txt
```

ADVANCED USAGE

Similar to `tcpdump`, the power really shows itself when you start combining queries.

SHOW ME EVERYTHING DANIEL IS DOING CONNECTED TO 1.1.1.1

```
# lsof -u daniel -i @1.1.1.1
```

```
bkdr   1893 daniel 3u  IPv6 3456 TCP 10.10.1.10:1234->1.1.1.1:31337 (ESTABLISH
```

USING THE `-T` AND `-C` OPTIONS TOGETHER TO HUP PROCESSES

```
# kill -HUP `lsof -t -c sshd`
```

SHOW OPEN CONNECTIONS WITH A PORT RANGE

```
# lsof -i @fw.google.com:2150=2180
```

CONCLUSION

This primer just scratches the surface of `lsof`'s functionality. For a full reference, run `man lsof` or check out the online version. I hope this has been useful to you, and as always, comments and corrections are welcomed.