

## Get a grip on those network connections with pstree and lsof

As you know, you can string Linux commands together to achieve larger and more complicated tasks. Here we will look at locating processes that are connecting over the network. We will see how to locate established and listening endpoints.

We will also print process trees to understand how Apache2 forks processes to do load balancing of network connections.

First, let's check all open files that are Internet addresses. All network connections will be identified by a network file (such as an Internet socket, which we are interested in here).

**lsof -i**

This will show you all open files that are associated with network files. If you are interested in either listening sockets or established connections, you can use grep for that:

```
lsof -i | grep LISTEN
lsof -i | grep ESTABLISHED
```

```
firefox 7120 p-c 29u IPv4 46651 0t0 TCP 10.0.2.15:55338->ec2-52-35-56-158.us-west-2.compute.amazonaws.com:https (ESTABLISHED)
firefox 7120 p-c 44u IPv4 46649 0t0 TCP 10.0.2.15:37892->server-54-230-128-162.ams50.r.cloudfront.net:https (ESTABLISHED)
firefox 7120 p-c 75u IPv4 45552 0t0 TCP 10.0.2.15:43102->93.184.220.29:http (ESTABLISHED)
```

Here we see established connections from Firefox to a web server. Now let's take a look at some Apache2 processes.

**lsof -i | grep apache2**

Here we can see the listening Apache2 processes as well as the established Firefox connection from the same computer. Notice how the parent Apache2 process is owned by user root and the forked Apache2 processes are owned by the www-data user.

```
apache2 6993 root 4u IPv6 43430 0t0 TCP *:8000 (LISTEN)
apache2 6997 www-data 4u IPv6 43430 0t0 TCP *:8000 (LISTEN)
apache2 6997 www-data 10u IPv6 59368 0t0 TCP localhost:8000->localhost:48652 (ESTABLISHED)
apache2 6998 www-data 4u IPv6 43430 0t0 TCP *:8000 (LISTEN)
```

To understand this better, see the following screenshot where use **pstree** to understand the hierarchy of the Apache2 processes.

```
p-c@LAMPWP:~/course-dataacomp/lesson8$ sudo lsof -i | grep apache2
apache2 6993 root 4u IPv6 43430 0t0 TCP *:8000 (LISTEN)
apache2 6997 www-data 4u IPv6 43430 0t0 TCP *:8000 (LISTEN)
apache2 6997 www-data 10u IPv6 59368 0t0 TCP localhost:8000->localhost:48652 (ESTABLISHED)
apache2 6998 www-data 4u IPv6 43430 0t0 TCP *:8000 (LISTEN)
p-c@LAMPWP:~/course-dataacomp/lesson8$ pstree 6993
apache2—2*[apache2—26*[{apache2}]]
p-c@LAMPWP:~/course-dataacomp/lesson8$ pstree 6997
apache2—26*[{apache2}]
p-c@LAMPWP:~/course-dataacomp/lesson8$ pstree 6998
apache2—26*[{apache2}]
```