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systemd for Administrators, Part II

Here's the second installment of my [ongoing series about systemd for](#)

administrators.

Which Service Owns Which Processes?

On most Linux systems the number of processes that are running by default is substantial. Knowing which process does what and where it belongs to becomes increasingly difficult. Some services even maintain a couple of worker processes which clutter the "ps" output with many additional processes that are often not easy to recognize. This is further complicated if daemons spawn arbitrary 3rd-party processes, as Apache does with CGI processes, or cron does with user jobs.

A slight remedy for this is often the process inheritance tree, as shown by "ps xaf". However this is usually not reliable, as processes whose parents die get reparented to PID 1, and hence all information about inheritance gets lost. If a process "double forks" it hence loses its relationships to the processes that started it. (This actually is supposed to be a feature and is relied on for the traditional Unix daemonizing logic.) Furthermore processes can freely change their names with PR_SETNAME or by patching argv[0], thus making it harder to recognize them. In fact they can play hide-and-seek with the administrator pretty nicely this way.

In systemd we place every process that is spawned in a *control group* named after its service. Control groups (or *cgroups*) at their most basic are simply groups of processes that can be arranged in a hierarchy and labelled individually. When processes spawn other processes these children are automatically made members of the parents cgroup. Leaving a cgroup is not possible for unprivileged processes. Thus, cgroups can be used as an effective way to label processes after the service they belong to and be sure that the service cannot escape from the label.

regardless how often it forks or renames itself. Furthermore this can be used to safely kill a service and all processes it created, again with no chance of escaping.

In today's installment I want to introduce you to two commands you may use to relate systemd services and processes. The first one, is the well known ps command which has been updated to show cgroup information along the other process details. And this is how it looks:

```
$ ps xawf -eo pid,user,cgroup,args
PID USER      CGROUP          COMMAND
   2 root        -                [kthreadd]
   3 root        -                \_ [ksoftirqd/0]
[... ]
4281 root        -                \_ [flush-8:0]
   1 root        name=systemd:/systemd-1 /sbin/init
  455 root        name=systemd:/systemd-1/sysinit.service /sbin/udev -d
28188 root        name=systemd:/systemd-1/sysinit.service \_ /sbin/udev -d
28191 root        name=systemd:/systemd-1/sysinit.service \_ /sbin/udev -d
 1096 dbus        name=systemd:/systemd-1/dbus.service /bin/dbus-daemon --system
 1131 root        name=systemd:/systemd-1/auditd.service auditd
 1133 root        name=systemd:/systemd-1/auditd.service \_ /sbin/auditd
 1135 root        name=systemd:/systemd-1/auditd.service \_ /usr/sbin/sed
 1171 root        name=systemd:/systemd-1/NetworkManager.service /usr/sbin/NetworkManager
 4028 root        name=systemd:/systemd-1/NetworkManager.service \_ /sbin/dhclient
 1175 avahi        name=systemd:/systemd-1/avahi-daemon.service avahi-daemon: r
 1194 avahi        name=systemd:/systemd-1/avahi-daemon.service \_ avahi-daemon
 1193 root        name=systemd:/systemd-1/rsyslog.service /sbin/rsyslogd -c 4
 1195 root        name=systemd:/systemd-1/cups.service cupsd -C /etc/cups/cups
 1207 root        name=systemd:/systemd-1/mdmonitor.service mdadm --monitor --
 1210 root        name=systemd:/systemd-1/irqbalance.service irqbalance
 1216 root        name=systemd:/systemd-1/dbus.service /usr/sbin/modem-manager
 1219 root        name=systemd:/systemd-1/dbus.service /usr/libexec/polkit-1/p
 1242 root        name=systemd:/systemd-1/dbus.service /usr/sbin/wpa_supplicant
 1249 68           name=systemd:/systemd-1/haldaemon.service hald
 1250 root        name=systemd:/systemd-1/haldaemon.service \_ hald-runner
 1273 root        name=systemd:/systemd-1/haldaemon.service \_ hald-addon
 1275 root        name=systemd:/systemd-1/haldaemon.service \_ /usr/libexec
 1284 root        name=systemd:/systemd-1/haldaemon.service \_ /usr/libexec
 1285 root        name=systemd:/systemd-1/haldaemon.service \_ /usr/libexec
 1287 68           name=systemd:/systemd-1/haldaemon.service \_ /usr/libexec
```

```

1317 root name=systemd:/systemd-1/abrtd.service /usr/sbin/abrtd -d -s
1332 root name=systemd:/systemd-1/getty@.service/tty2 /sbin/mingetty t
1339 root name=systemd:/systemd-1/getty@.service/tty3 /sbin/mingetty t
1342 root name=systemd:/systemd-1/getty@.service/tty5 /sbin/mingetty t
1343 root name=systemd:/systemd-1/getty@.service/tty4 /sbin/mingetty t
1344 root name=systemd:/systemd-1/crond.service crond
1346 root name=systemd:/systemd-1/getty@.service/tty6 /sbin/mingetty t
1362 root name=systemd:/systemd-1/sshd.service /usr/sbin/sshd
1376 root name=systemd:/systemd-1/prefdm.service /usr/sbin/gdm-binary
1391 root name=systemd:/systemd-1/prefdm.service \_ /usr/libexec/gdm-
1394 root name=systemd:/systemd-1/prefdm.service \_ /usr/bin/Xorg
1495 root name=systemd:/user/lennart/1 \_ pam: gdm-passwor
1521 lennart name=systemd:/user/lennart/1 \_ gnome-sessio
1621 lennart name=systemd:/user/lennart/1 \_ metacity
1635 lennart name=systemd:/user/lennart/1 \_ gnome-pa
1638 lennart name=systemd:/user/lennart/1 \_ nautilus
1640 lennart name=systemd:/user/lennart/1 \_ /usr/lib
1641 lennart name=systemd:/user/lennart/1 \_ /usr/bin
1644 lennart name=systemd:/user/lennart/1 \_ gnome-vo
1646 lennart name=systemd:/user/lennart/1 \_ /usr/sbi
1652 lennart name=systemd:/user/lennart/1 \_ /usr/bin
1662 lennart name=systemd:/user/lennart/1 \_ nm-apple
1664 lennart name=systemd:/user/lennart/1 \_ gnome-po
1665 lennart name=systemd:/user/lennart/1 \_ /usr/lib
1670 lennart name=systemd:/user/lennart/1 \_ /usr/lib
1672 lennart name=systemd:/user/lennart/1 \_ /usr/bin
1674 lennart name=systemd:/user/lennart/1 \_ /usr/lib
1675 lennart name=systemd:/user/lennart/1 \_ abrt-app
1677 lennart name=systemd:/user/lennart/1 \_ bluetooth
1678 lennart name=systemd:/user/lennart/1 \_ gpk-upda
1408 root name=systemd:/systemd-1/console-kit-daemon.service /usr/sbin
1419 gdm name=systemd:/systemd-1/prefdm.service /usr/bin/dbus-launch
1453 root name=systemd:/systemd-1/dbus.service /usr/libexec/upowerd
1473 rtkit name=systemd:/systemd-1/rtkit-daemon.service /usr/libexec/rt
1496 root name=systemd:/systemd-1/accounts-daemon.service /usr/libexec
1499 root name=systemd:/systemd-1/systemd-logger.service /lib/systemd/
1511 lennart name=systemd:/systemd-1/prefdm.service /usr/bin/gnome-keyrin
1534 lennart name=systemd:/user/lennart/1 dbus-launch --sh-syntax
1535 lennart name=systemd:/user/lennart/1 /bin/dbus-daemon --fork
1603 lennart name=systemd:/user/lennart/1 /usr/libexec/gconfd-2
1612 lennart name=systemd:/user/lennart/1 /usr/libexec/gnome-setti
1615 lennart name=systemd:/user/lennart/1 /usr/libexec/gvfsd
1626 lennart name=systemd:/user/lennart/1 /usr/libexec//gvfs-fuse-
1634 lennart name=systemd:/user/lennart/1 /usr/bin/pulseaudio --st

```

```

1649 lennart name=systemd:/user/lennart/1          \_ /usr/libexec/pulse/g
1645 lennart name=systemd:/user/lennart/1          /usr/libexec/bonobo-acti
1668 lennart name=systemd:/user/lennart/1          /usr/libexec/im-settings
1701 lennart name=systemd:/user/lennart/1          /usr/libexec/gvfs-gdu-vo
1707 lennart name=systemd:/user/lennart/1          /usr/bin/gnote --panel-a
1725 lennart name=systemd:/user/lennart/1          /usr/libexec/clock-apple
1727 lennart name=systemd:/user/lennart/1          /usr/libexec/wnck-applet
1729 lennart name=systemd:/user/lennart/1          /usr/libexec/notificatio
1733 root    name=systemd:/systemd-1/dbus.service /usr/libexec/udisks-dae
1747 root    name=systemd:/systemd-1/dbus.service \_ udisks-daemon: poll
1759 lennart name=systemd:/user/lennart/1          gnome-screensaver
1780 lennart name=systemd:/user/lennart/1          /usr/libexec/gvfsd-trash
1864 lennart name=systemd:/user/lennart/1          /usr/libexec/gvfs-afc-vo
1874 lennart name=systemd:/user/lennart/1          /usr/libexec/gconf-im-se
1903 lennart name=systemd:/user/lennart/1          /usr/libexec/gvfsd-burn
1909 lennart name=systemd:/user/lennart/1          gnome-terminal
1913 lennart name=systemd:/user/lennart/1          \_ gnome-pty-helper
1914 lennart name=systemd:/user/lennart/1          \_ bash
29231 lennart name=systemd:/user/lennart/1          | \_ ssh tango
2221 lennart name=systemd:/user/lennart/1          \_ bash
4193 lennart name=systemd:/user/lennart/1          | \_ ssh tango
2461 lennart name=systemd:/user/lennart/1          \_ bash
29219 lennart name=systemd:/user/lennart/1          | \_ emacs systemd-fo
15113 lennart name=systemd:/user/lennart/1          \_ bash
27251 lennart name=systemd:/user/lennart/1          \_ empathy
29504 lennart name=systemd:/user/lennart/1          \_ ps xawf -eo pid,
1968 lennart name=systemd:/user/lennart/1          ssh-agent
1994 lennart name=systemd:/user/lennart/1          gpg-agent --daemon --wri
18679 lennart name=systemd:/user/lennart/1          /bin/sh /usr/lib64/firef
18741 lennart name=systemd:/user/lennart/1          \_ /usr/lib64/firefox-3
28900 lennart name=systemd:/user/lennart/1          \_ /usr/lib64/nsplu
4016 root    name=systemd:/systemd-1/sysinit.service /usr/sbin/bluetoothd
4094 smmsp   name=systemd:/systemd-1/sendmail.service sendmail: Queue run
4096 root    name=systemd:/systemd-1/sendmail.service sendmail: accepting
4112 ntp      name=systemd:/systemd-1/ntpd.service /usr/sbin/ntpd -n -u ntp
27262 lennart name=systemd:/user/lennart/1          /usr/libexec/mission-con
27265 lennart name=systemd:/user/lennart/1          /usr/libexec/telepathy-h
27268 lennart name=systemd:/user/lennart/1          /usr/libexec/telepathy-l
27270 lennart name=systemd:/user/lennart/1          /usr/libexec/dconf-servi
27280 lennart name=systemd:/user/lennart/1          /usr/libexec/notificatio
27284 lennart name=systemd:/user/lennart/1          /usr/libexec/telepathy-g
27285 lennart name=systemd:/user/lennart/1          /usr/libexec/telepathy-s
27297 lennart name=systemd:/user/lennart/1          /usr/libexec/geoclue-yah

```

(Note that this output is shortened, I have removed most of the kernel threads here, since they are not relevant in the context of this blog story)

In the third column you see the cgroup systemd assigned to each process. You'll find that the udev processes are in the name=systemd:/systemd-1/sysinit.service cgroup, which is where systemd places all processes started by the sysinit.service service, which covers early boot.

My personal recommendation is to set the shell alias psc to the ps command line shown above:

```
alias psc='ps xawf -eo pid,user,cgroup,args'
```

With this service information of processes is just four keypresses away!

A different way to present the same information is the `systemd-cgls` tool we ship with systemd. It shows the cgroup hierarchy in a pretty tree. Its output looks like this:

```
$ systemd-cgls
+ 2 [kthreadd]
[... ]
+ 4281 [flush-8:0]
+ user
| \ lennart
| \ 1
|   + 1495 pam: gdm-password
|   + 1521 gnome-session
|   + 1534 dbus-launch --sh-syntax --exit-with-session
|   + 1535 /bin/dbus-daemon --fork --print-pid 5 --print-address 7 --ses
|   + 1603 /usr/libexec/gconfd-2
|   + 1612 /usr/libexec/gnome-settings-daemon
|   + 1615 /usr/libexec/gvfsd
|   + 1621 metacity
|   + 1626 /usr/libexec/gvfs-fuse-daemon /home/lennart/.gvfs
```

```
+ 1634 /usr/bin/pulseaudio --start --log-target=syslog
+ 1635 gnome-panel
+ 1638 nautilus
+ 1640 /usr/libexec/polkit-gnome-authentication-agent-1
+ 1641 /usr/bin/seapplet
+ 1644 gnome-volume-control-applet
+ 1645 /usr/libexec/bonobo-activation-server --ac-activate --ior-out
+ 1646 /usr/sbin/restorecond -u
+ 1649 /usr/libexec/pulse/gconf-helper
+ 1652 /usr/bin/devilspie
+ 1662 nm-applet --sm-disable
+ 1664 gnome-power-manager
+ 1665 /usr/libexec/gdu-notification-daemon
+ 1668 /usr/libexec/im-settings-daemon
+ 1670 /usr/libexec/evolution/2.32/evolution-alarm-notify
+ 1672 /usr/bin/python /usr/share/system-config-printer/applet.py
+ 1674 /usr/lib64/deja-dup/deja-dup-monitor
+ 1675 abrt-applet
+ 1677 bluetooth-applet
+ 1678 gpk-update-icon
+ 1701 /usr/libexec/gvfs-gdu-volume-monitor
+ 1707 /usr/bin/gnote --panel-applet --oaf-activate-iid=OAFIID:Gnote
+ 1725 /usr/libexec/clock-applet
+ 1727 /usr/libexec/wnck-applet
+ 1729 /usr/libexec/notification-area-applet
+ 1759 gnome-screensaver
+ 1780 /usr/libexec/gvfsd-trash --spawner :1.9 /org/gtk/gvfs/exec_sp
+ 1864 /usr/libexec/gvfs-afc-volume-monitor
+ 1874 /usr/libexec/gconf-im-settings-daemon
+ 1882 /usr/libexec/gvfs-gphoto2-volume-monitor
+ 1903 /usr/libexec/gvfsd-burn --spawner :1.9 /org/gtk/gvfs/exec_spa
+ 1909 gnome-terminal
+ 1913 gnome-pty-helper
+ 1914 bash
+ 1968 ssh-agent
+ 1994 gpg-agent --daemon --write-env-file
+ 2221 bash
+ 2461 bash
+ 4193 ssh tango
+ 15113 bash
+ 18679 /bin/sh /usr/lib64/firefox-3.6/run-mozilla.sh /usr/lib64/fire
+ 18741 /usr/lib64/firefox-3.6/firefox
+ 27251 empathy
+ 27262 /usr/libexec/mission-control-5
```

```

| + 27265 /usr/libexec/telepathy-haze
| + 27268 /usr/libexec/telepathy-logger
| + 27270 /usr/libexec/dconf-service
| + 27280 /usr/libexec/notification-daemon
| + 27284 /usr/libexec/telepathy-gabble
| + 27285 /usr/libexec/telepathy-salut
| + 27297 /usr/libexec/geoclue-yahoo
| + 28900 /usr/lib64/nspluginwrapper/npviewer.bin --plugin /usr/lib64/m
| + 29219 emacs systemd-for-admins-1.txt
| + 29231 ssh tango
| \ 29519 systemd-cgls
\ systemd-1
+ 1 /sbin/init
+ ntpd.service
| \ 4112 /usr/sbin/ntpd -n -u ntp:ntp -g
+ systemd-logger.service
| \ 1499 /lib/systemd/systemd-logger
+ accounts-daemon.service
| \ 1496 /usr/libexec/accounts-daemon
+ rtkit-daemon.service
| \ 1473 /usr/libexec/rtkit-daemon
+ console-kit-daemon.service
| \ 1408 /usr/sbin/console-kit-daemon --no-daemon
+ prefdm.service
| + 1376 /usr/sbin/gdm-binary -nodaemon
| + 1391 /usr/libexec/gdm-simple-slave --display-id /org/gnome/DisplayMan.
| + 1394 /usr/bin/Xorg :0 -nr -verbose -auth /var/run/gdm/auth-for-gdm-f2
| + 1419 /usr/bin/dbus-launch --exit-with-session
| \ 1511 /usr/bin/gnome-keyring-daemon --daemonize --login
+ getty@.service
| + tty6
| | \ 1346 /sbin/mingetty tty6
| + tty4
| | \ 1343 /sbin/mingetty tty4
| + tty5
| | \ 1342 /sbin/mingetty tty5
| + tty3
| | \ 1339 /sbin/mingetty tty3
| \ tty2
| \ 1332 /sbin/mingetty tty2
+ abrt.service
| \ 1317 /usr/sbin/abrt -d -s
+ crond.service
| \ 1344 crond

```



```
+ sshd.service
| \ 1362 /usr/sbin/sshd
+ sendmail.service
| + 4094 sendmail: Queue runner@01:00:00 for /var/spool/clientmqueue
| \ 4096 sendmail: accepting connections
+ haldaemon.service
| + 1249 hald
| + 1250 hald-runner
| + 1273 hald-addon-input: Listening on /dev/input/event3 /dev/input/event4
| + 1275 /usr/libexec/hald-addon-rfkill-killswitch
| + 1284 /usr/libexec/hald-addon-leds
| + 1285 /usr/libexec/hald-addon-generic-backlight
| \ 1287 /usr/libexec/hald-addon-acpi
+ irqbalance.service
| \ 1210 irqbalance
+ avahi-daemon.service
| + 1175 avahi-daemon: running [epsilon.local]
+ NetworkManager.service
| + 1171 /usr/sbin/NetworkManager --no-daemon
| \ 4028 /sbin/dhclient -d -4 -sf /usr/libexec/nm-dhcp-client.action -pf /var/run/nm-dhcp-client.action
+ rsyslog.service
| \ 1193 /sbin/rsyslogd -c 4
+ mdmonitor.service
| \ 1207 mdadm --monitor --scan -f --pid-file=/var/run/mdadm/mdadm.pid
+ cups.service
| \ 1195 cupsd -C /etc/cups/cupsd.conf
+ auditd.service
| + 1131 auditd
| + 1133 /sbin/audispd
| \ 1135 /usr/sbin/sedispach
+ dbus.service
| + 1096 /bin/dbus-daemon --system --address=systemd: --nofork --systemd
| + 1216 /usr/sbin/modem-manager
| + 1219 /usr/libexec/polkit-1/polkitd
| + 1242 /usr/sbin/wpa_supplicant -c /etc/wpa_supplicant/wpa_supplicant.conf
| + 1453 /usr/libexec/upowerd
| + 1733 /usr/libexec/udisks-daemon
| + 1747 udisks-daemon: polling /dev/sr0
| \ 29509 /usr/libexec/packagekitd
+ dev-mqueue.mount
+ dev-hugepages.mount
\ sysinit.service
+ 455 /sbin/udev -d
+ 4016 /usr/sbin/bluetoothd --udev
```

```
+ 28188 /sbin/udev -d  
\ 28191 /sbin/udev -d
```

(This too is shortened, the same way)

As you can see, this command shows the processes by their cgroup and hence service, as systemd labels the cgroups after the services. For example, you can easily see that the auditing service `auditd.service` spawns three individual processes, `auditd`, `audisp` and `sedispatch`.

If you look closely you will notice that a number of processes have been assigned to the cgroup `/user/1`. At this point let's simply leave it at that `systemd not only maintains services in cgroups, but user session processes as well`. In a later installment we'll discuss in more detail what this about.

So much for now, come back soon for the next installment!

Category: projects

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