05-4 Userspace Initialization - systemd

Chapter 6

Beagle 3.8

beagle$ cat /etc/init.d/README

```
You are running a systemd-based OS where traditional init scripts have
been replaced by native systemd services files. Service files provide
very similar functionality to init scripts. To make use of service
files simply invoke "systemctl", which will output a list of all
currently running services (and other units). Use "systemctl
list-unit-files" to get a listing of all known unit files, including
stopped, disabled and masked ones. Use "systemctl start
foobar.service" and "systemctl stop foobar.service" to start or stop a
service, respectively. For further details, please refer to
systemctl(1).
```

Beagle 3.8 (cont)

beagle$ cat /etc/init.d/README

```
Note that traditional init scripts continue to function on a systemd
system. An init script /etc/init.d/foobar is implicitly mapped
into a service unit foobar.service during system initialization.

Thank you!

Further reading:
        man:systemctl(1)
        man:systemd(1)
        http://0pointer.de/blog/projects/systemd-for-admins-3.html

http://www.freedesktop.org/wiki/Software/systemd/Incompatibilities
```

systemd

- init.d is not used on the bone
- systemd is used for user space initialization
- http://www.freedesktop.org/wiki/Software/systemd/
- Faster boot time by allowing initialization in parallel

Linux distributions that include systemd

Linux distribution	Date added to software repository[1]	Enabled by default?
Arch Linux	October 2012[10]	Yes
Debian GNU/Linux[11][2]	April 2012	No
Fedora	May 2011 (v15)[12]	Yes
Frugalware Linux	August 2011 (v1.5)[13]	Yes
Gentoo Linux	2011[14][15][16]	No
Mageia	May 2012 (v2.0)[17]	Yes
openSUSE	March 2011 (v11.4)[18]	Yes, since 2012-09-15 (v12.2)
Red Hat Enterprise Linux[19]	Pending	No
Sabayon Linux	August 2013 (v13.08)[20]	Yes
Ubuntu[3]	April 2013 (v13.04)[21]	No

http://en.wikipedia.org/wiki/Systemd

Outline

- Being an Admin
  - Monitoring boot up
  - cgroup
  - Stopping, starting, etc.
  - Boot time
- Running your own server

Bootup

- Much scrolls by during boot time

```
Starting kernel ...
76
77 Uncompressing Linux... done, booting the kernel.
78 [ 0.000000] Booting Linux on physical CPU 0x0
79 [ 0.000000] Initializing cgroup subsys cpu
80 [ 0.000000] Linux version 3.8.13-bone27 (yoder@ubuntu) (gcc version 4.7.3
20130328
(prerelease) (crosstool-NG linaro-1.13.1-4.7-2013.04-20130415 - Linaro GCC
2013.04) )
#1 SMP Thu Aug 29 19:57:17 EDT 2013
81 [ 0.000000] CPU: ARMv7 Processor [413fc082] revision 2 (ARMv7), cr=10c5387d
82 [ 0.000000] CPU: PIPT / VIPT nonaliasing data cache, VIPT aliasing instruction
cache
83 [ 0.000000] Machine: Generic AM33XX (Flattened Device Tree), model: TI AM335x
BeagleBone
```

- What if you miss something?

systemctl – Seeing what's running

- You can see the status of various processes using systemctl

systemctl

```
beagle $ systemctl
UNIT                          LOAD   ACTIVE SUB       DESCRIPTION
proc-sys...t_misc.automount loaded active waiting   Arbitrary Executable File Formats File System Automount Point
sys-devi...tty-ttyO0.device loaded active plugged   /sys/devices/ocp.2/44e09000.serial/tty/ttyO0
sys-devi...ty-ttyGS0.device loaded active plugged   /sys/devices/ocp.2/47400000.usb/musb-hdrc.0.auto/gadget/tty/ttyGS0
sys-devi...-net-eth0.device loaded active plugged   /sys/devices/ocp.2/4a100000.ethernet/net/eth0
sys-devi...blk0boot0.device loaded active plugged   /sys/devices/ocp.2/mmc.10/mmc_host/mmc1/mmc1:0001/block/mmcblk0/mmcblk0boot0
sys-devi...blk0boot1.device loaded active plugged   /sys/devices/ocp.2/mmc.10/mmc_host/mmc1/mmc1:0001/block/mmcblk0/mmcblk0boot1
sys-devi...mmcblk0p1.device loaded active plugged   /sys/devices/ocp.2/mmc.10/mmc_host/mmc1/mmc1:0001/block/mmcblk0/mmcblk0p1
sys-devi...mmcblk0p2.device loaded active plugged   /sys/devices/ocp.2/mmc.10/mmc_host/mmc1/mmc1:0001/block/mmcblk0/mmcblk0p2
sys-devi...k-mmcblk0.device loaded active plugged   /sys/devices/ocp.2/mmc.10/mmc_host/mmc1/mmc1:0001/block/mmcblk0
sys-devi...tty-ttyS0.device loaded active plugged   /sys/devices/platform/serial8250/tty/ttyS0
sys-devi...tty-ttyS1.device loaded active plugged   /sys/devices/platform/serial8250/tty/ttyS1
sys-devi...tty-ttyS2.device loaded active plugged   /sys/devices/platform/serial8250/tty/ttyS2
sys-devi...tty-ttyS3.device loaded active plugged   /sys/devices/platform/serial8250/tty/ttyS3
sys-module-fuse.device      loaded active plugged   /sys/module/fuse
sys-subs...ices-eth0.device loaded active plugged   /sys/subsystem/net/devices/eth0
-.mount                     loaded active mounted   /
dev-mqueue.mount            loaded active mounted   POSIX Message Queue File System
sys-fs-f...onnections.mount loaded active mounted   FUSE Control File System
sys-kernel-debug.mount      loaded active mounted   Debug File System
tmp.mount                   loaded active mounted   /tmp
systemd-...ord-console.path loaded active waiting   Dispatch Password Requests to Console Directory Watch
```

systemctl

```
beagle $ systemctl
UNIT                          LOAD   ACTIVE SUB       DESCRIPTION
bonescript-autorun.service  loaded active running   Bonescript autorun
bonescript.service          loaded active running   Bonescript server
cloud9.service              loaded active running   Cloud9 IDE
connman.service             loaded active running   Connection service
console-...em-start.service loaded active exited    Console System Startup Logging
crond.service               loaded active running   Periodic Command Scheduler
dbus.service                loaded active running   D-Bus System Message Bus
dropbear....1:42389.service loaded active running   SSH Per-Connection Server
gateone.service             loaded active running   GateOne daemon
gdm.service                 loaded active running   Gnome Display Manager
getty@tty1.service          loaded active running   Getty on tty1
leds.service                loaded active exited    Angstrom LED config
mpd.service                 loaded failed failed    Music Player Daemon
ntpdate.service             loaded active exited    Network Time Service (one-shot ntpdate mode)
serial-getty@ttyGS0.service loaded active running   Serial Getty on ttyGS0
serial-getty@ttyO0.service  loaded active running   Serial Getty on ttyO0
```

Systemctl status

beagle$ **systemctl status mpd.service**

```
mpd.service - Music Player Daemon
              Loaded: loaded (/lib/systemd/system/mpd.service; enabled)
              Active: failed (Result: signal) since Mon 2000-01-03 12:44:01 EST; 13 years 9 months ago
             Process: 125 ExecStart=/usr/bin/mpd --no-daemon (code=killed, signal=ABRT)
              CGroup: name=systemd:/system/mpd.service
```

Systemctl status

beagle$ **systemctl status mpd.service**

...

```
Jan 03 12:44:01 yoder-black-bone systemd[1]: mpd.service: main process exited, code=killed, status=6/ABRT
Jan 03 12:44:01 yoder-black-bone systemd[1]: Unit mpd.service entered failed state
Jan 03 12:44:10 yoder-black-bone mpd[125]: listen: bind to '0.0.0.0:6600' failed: Address already in use (continuing anyway, because binding to '[::]:6600' succeeded)
Jan 03 12:44:10 yoder-black-bone mpd[125]: output: No "audio_output" defined in config file
Jan 03 12:44:10 yoder-black-bone mpd[125]: output: Attempt to detect audio output device
Jan 03 12:44:10 yoder-black-bone mpd[125]: output: Attempting to detect a alsa audio device
Jan 03 12:44:10 yoder-black-bone mpd[125]: ALSA lib confmisc.c:768:(parse_card) cannot find card '0'
pa_threaded_mainloop_get_api(). Aborting.
```

cgroup - Which Service Owns Which Processes?

- One process can start other processes
- It's hard to tell which process runs what
- *Control groups* (cgroups) are groups of processes
- In systemd every process that is spawned is placed in a control group named after its service
- Makes it easier to track down problems

cgroup

```
beagle$ systemd-cgls
|-user
| `-root
|   `-c1
|     |- 307 /bin/login --
|     |- 512 -sh
|     |- 513 bash
|     |-2211 systemd-cgls
|     `-2212 less
`-system
```

cgroup

```
beagle$ systemd-cgls
…
`-system
  |-1 /sbin/init
  |-dropbear@.service
  | `-4
  |   |- 395 /usr/sbin/dropbear -i -r /etc/dropbear/dropbear_rsa_host_key -p ...
  |   |- 396 -sh
  |   |- 398 bash
  |   |- 577 dbus-launch --autolaunch e4fd50946e154a7db1fcbec184b13853 --bina...
  |   |- 578 /usr/bin/dbus-daemon --fork --print-pid 5 --print-address 7 --se...
  |   |- 580 /usr/libexec/gconfd-2
  |   `-1682 /usr/bin/node ./boneServer.js
  |-bonescript.service
  | `-349 /usr/bin/node server.js
```

cgroup

```
beagle$ systemd-cgls
…
`-system
…
  |-cloud9.service
  | `-128 /usr/bin/node4 /usr/share/cloud9/bin/cloud9.js -l 0.0.0.0 -w /var/l...
  |-gateone.service
  | `-127 /usr/bin/python gateone.py
  |-bonescript-autorun.service
  | `-126 /usr/bin/node autorun.js
  |-storage-gadget-init.service
  | |-124 /bin/sh /usr/bin/g-ether-load.sh
  | `-268 /usr/sbin/udhcpd -f -S /etc/udhcpd.conf
  |-connman.service
  | `-122 /usr/sbin/connmand -n
  |-avahi-daemon.service
  | |-121 avahi-daemon: running [yoder-black-bone.local]
  | `-199 avahi-daemon: chroot helper
  |-systemd-journald.service
  | `-84 /lib/systemd/systemd-journald
  `-systemd-udevd.service
    `-83 /lib/systemd/systemd-udevd
```

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Managing

```
beagle$ systemctl status systemd-journald.service
systemd-journald.service - Journal Service
          Loaded: loaded (/lib/systemd/system/systemd-journald.service; static)
          Active: mactive (running)since Mon 2000-01-03 12:43:56 EST; 13 years 9
months ago
            Docs: man:systemd-journald.service(8)
                  man:journald.conf(5)
        Main PID: 84 (systemd-journal)
          Status: "Processing requests..."
          CGroup: name=systemd:/system/systemd-journald.service
                  `-84 /lib/systemd/systemd-journald

Jan 03 12:43:56 yoder-black-bone systemd-journal[84]: Allowing runtime journa...
Jan 03 12:43:57 yoder-black-bone systemd-journal[84]: Journal started
Jan 03 12:43:59 yoder-black-bone systemd-journal[84]: Allowing system journal...
Warning: Journal has been rotated since unit was started. Log output is incomplete
or unavailable.
```

Managing

- Stop, start, disable, enable


```
beagle$ systemctl stop systemd-journald.service
Warning: Stopping systemd-journald.service, but it can still be activated by:
  systemd-journald.socket
beagle$ systemctl start systemd-journald.service
beagle$ systemctl disable systemd-journald.service
beagle$ systemctl enable systemd-journald.service
The unit files have no [Install] section. They are not meant to be enabled
using systemctl.
Possible reasons for having this kind of units are:
1) A unit may be statically enabled by being symlinked from another unit's
   .wants/ or .requires/ directory.
2) A unit's purpose may be to act as a helper for some other unit which has
   a requirement dependency on it.
3) A unit may be started when needed via activation (socket, path, timer,
   D-Bus, udev, scripted systemctl call, ...).
```

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Boot performance

```
beagle$ systemd-analyze
Startup finished in 1590ms (kernel) + 9147ms (userspace) = 10738ms
beagle$ systemd-analyze blame
  2658ms avahi-daemon.service
  2642ms connman.service
  2586ms systemd-logind.service
  1549ms console-kit-log-system-start.service
  1440ms ntpdate.service
  1003ms systemd-udev-trigger.service
   438ms systemd-modules-load.service
   262ms systemd-udevd.service
   224ms systemd-tmpfiles-setup.service
   217ms systemd-remount-fs.service
   208ms dev-mqueue.mount
   192ms sys-kernel-debug.mount
   137ms wpa_supplicant.service
   115ms systemd-user-sessions.service
    99ms systemd-sysctl.service
    55ms sys-fs-fuse-connections.mount
    42ms tmp.mount
```

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Autostarting a server

- For and example, let's use the server in

```
beagle$ cd exercises/realtime
beagle$ ./boneServer.js
 Listening on 8080
    info  - socket.io started
```

- How do you write your own service script?

Find a working script

```
beagle$ systemctl | grep bone
bonescript-autorun.service  loaded active running   Bonescript autorun
bonescript.service          loaded active running   Bonescript server
bonescript.socket           loaded active running   bonescript.socket
```

- I see a couple of bonescript servers that look promising.

```
beagle$ systemctl status bonescript
bonescript.service - Bonescript server
   Loaded: loaded (/lib/systemd/system/bonescript.service; static)
   Active: active (running) since Sun 2000-01-09 15:07:55 EST; 13 years 9 months ago
   Main PID: 357 (node)
         CGroup: name=systemd:/system/bonescript.service
            `-357 /usr/bin/node server.js

Jan 09 15:07:55 yoder-black-bone systemd[1]: Starting Bonescript server...
Jan 09 15:08:04 yoder-black-bone bonescript[357]: [35B blob data]
Jan 09 15:08:05 yoder-black-bone bonescript[357]: - - - [Sun, 09 Jan 2000 20:...
```

Copy

```
beagle$ cp /lib/systemd/system/bonescript.service boneServer.service
beagle$ cat boneServer.service
[Unit]
Description=Bonescript server

[Service]
WorkingDirectory=/usr/lib/node_modules/bonescript
ExecStart=/usr/bin/node server.js
SyslogIdentifier=bonescript

[Install]
WantedBy=multi-user.target
```

Environment Variables

- Node.js also needs

```
beagle$ echo $NODE_PATH
/usr/lib/node_modules
```

- You get to figure out how to set it.

Install

```
beagle$ cp boneServer.service
/lib/systemd/system
```

- Start the server

```
beagle$ systemctl start boneServer
```

- Point your browser to 192.168.7.2:8080 and see if it works.
- To make it work after rebooting

```
beagle$ systemctl enable boneServer
ln -s '/lib/systemd/system/boneServer.service'
'/etc/systemd/system/multi-user.target.wants/boneServer.service'
```

- Reboot and see if it worked