

# OpenBSD rc.d(8)

**BSDCan 2016**

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- OpenBSD developer since 2006
- `ajacoutot@` aka `aja@`
- `sysmerge`, `rc.d`, `rc.subr`, `rcctl`, `libtool`...
- >400 ports, GNOME (Foundation member)
- `ftp.fr.openbsd.org`

rc.d(8) was brought to you by

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# Stuff we're going to talk about

- historical (& current) system boot process
- rc.d alternatives and requirements
- rc.d usage
- rc.subr internals
- rcctl

***“I went to Canada and all I  
got to see was a talk about a  
shell script!”***

# I can has consistency?

- `kill -HUP`
- `apachectl graceful`
- `rndc reload`
- `haproxy -sf $(cat /var/run/haproxy.pid)`

- boot loader -> kernel -> init
- init(1) uses sh(1) to run /etc/rc
- dependable, predictive, sequential
- dependency-less

`/etc/rc.conf`, default configuration

`/etc/rc.conf.local`, `rc.conf(8)` overrides

`daemon_flags=flags|NO`

`service=YES|NO`



- current paradigm cannot change
- preserve existing behavior
- plug rc.d on top (!= replacement)
- only handle daemons
- small, simple, robust, comprehensive
- easily debuggable

- SMF, launchd
- OpenRC
- runit, daemontools
- Slackware Linux rc.d
- FreeBSD and NetBSD rc.d + rcorder
- ...

- small and targeted to our requirements
- no supervision
- no event driven / socket activated
- no parallelization
- no automatic startup ordering

- October 2010: first implementation
- `/etc/rc.d/rc.subr`, `/etc/rc.d/foobar`
- designed for ports only
- base was the ultimate goal

- standard facility to signal daemons: `kill(1)`
- does not rely on PID files
- no `start-stop-daemon(8)`...
- good enough for ~95% of the ecosystem
- shell (`ksh`)

- rc.d scripts initially called from /etc/rc.local
  - no disruption to the existent
  - traditional way to start external daemons

```
for _r in $rc_scripts; do
    [ -x /etc/rc.d/${_r} ] && \
        /etc/rc.d/${_r} start && \
        echo -n " ${_r}"
done
```

- sourced by rc.d scripts
- provides all subroutines
- 54 LOC at that time



***“Who would need such a bloated interface?”***

- one release later: base system daemons
- why the change of mind?
  - process not started in isolation
  - unexpected and/or dangerous behavior

"su(1) -l" for environment sanitation

```
su root -c 'apachectl2 start'
```

versus

```
su root -c '/etc/rc.d/apache2 start'
```

XAUTHORITY	/var/run/gdm/auth-for-ajacoutot-m3vPl9/database
EC2_HOME	/usr/local/ec2-api-tools
LOGNAME	ajacoutot
WINDOWID	39950112
LC_PAPER	en_US.UTF-8
HOME	/root
JAVA_HOME	/usr/local/jdk-1.7.0
MORE	-e
GDM_LANG	en_US.UTF-8
XMODIFIERS	@im=ibus
LC_MONETARY	en_US.UTF-8
GNOME_DESKTOP_SESSION_ID	this-is-deprecated
XDG_SESSION_COOKIE	peck.home.bsdfrog.org-1457525880.169095-987613489
LANG	en_US.UTF-8
SSH_AUTH_SOCK	/tmp/ssh-fVY14JcellEs/agent.20253
LC_MEASUREMENT	en_US.UTF-8
SHELL	/bin/ksh
TERM	xterm-256color
DBUS_SESSION_BUS_ADDRESS	unix:path=/tmp/dbus-bTXFGN5XVm,guid=c1ba1bc5f3988d9ee7337f4156e0147b
USERNAME	ajacoutot
LC_NUMERIC	en_US.UTF-8
XDG_MENU_PREFIX	gnome-
WINDOWPATH	5
XDG_SESSION_TYPE	x11
PWD	/home/ajacoutot
DESKTOP_AUTOSTART_ID	10577b4c3ea13dc5f4145752588334626600000287180001
PKG_PATH	ftp.fr.openbsd.org
LD_LIBRARY_PATH	/usr/local/lib
LC_CTYPE	en_US.UTF-8
DISPLAY	:0
SSH_AGENT_PID	16845

*“Too much information!”*

# OpenBSD startup sequence

- do things -> start\_daemon() -> do other things -> start\_daemon() -> ...
- hostname.if, rc.securelevel, rc.local, rc.shutdown
- run\_upgrade\_script() (sysmerge, firsttime)

rc.d = small subset of the startup sequence

- rc.subr 224 LOC
- /etc/rc -150 LOC
  - source rc.subr (functions only)
  - start\_daemon()
  - start/stop pkg\_scripts (while loop)
- big feature gain for 70 LOC

- 4+1 actions available
  - *start* the daemon (flags, timeout, user, class, rtable)
  - *stop* the daemon (SIGTERM)
  - *reload* the daemon (SIGHUP)
  - *check* if the daemon is running (pgrep)
  - *restart* the daemon (stop && start)

- need to run as a privileged user (~!check)
- fully configurable and overridable
- main user interface: just a few knobs



# Minimal rc.d script

```
#!/bin/sh
```

```
#
```

```
# $OpenBSD$
```

```
daemon="/path/to/daemon"
```

```
. /etc/rc.d/rc.subr
```

```
rc_cmd $1
```

- 2 optional flags
  - -d debug mode
    - describe and display stdout/stderr
  - -f force mode
    - similar to *onstart*
    - no-op for packages rc.d scripts

- `daemon_flags`
  - base system daemons
- `pkg_scripts` (ordered or reversed)
  - package daemons

- `daemon_class`
  - default: `daemon`
  - BSD login class the daemon will run under  
(resource limits, environment variables...)

- `daemon_flags`
  - default: `NO|<empty>` (from `/etc/rc.conf`)
  - flags passed to the daemon

- `daemon_rtable`
  - default: 0
  - routing table to run the daemon under

- `daemon_timeout`
  - default: 30
  - maximum time in seconds to start/stop/reload a daemon

- daemon\_user
  - default: root
  - user the daemon will run as



- variables are overridable by
  - the rc.d script itself
  - `/etc/rc.conf`
  - `/etc/rc.conf.local`

- /etc/rc.d/netsnmpd
  - `daemon_flags="-u _netsnmp -I -ipv6"`
- rc.conf.local
  - `netsnmpd_flags=-u _netsnmp -a`

override: rc.d script name is substituted to *daemon*  
in the variable name

- set to a login class of the same name as the rc.d script
- ~~netsnmpd\_class=myclass~~

```
netsnmpd: \  
:openfiles-cur=512: \  
:tc=daemon:
```

```
apmd_flags=-A
```

```
hotplugd_flags=
```

```
saned_flags=-s128
```

```
ntpd_flags=NO
```

```
pkg_scripts=messagebus saned cupsd
```

- meta rc.d script
  - `/etc/rc.d/samba start`
  - `/etc/rc.d/smbd start && /etc/rc.d/nmbd start`

- multiple instances of the same daemon
  - In `-s /etc/rc.d/foobar /etc/rc.d/foobar2`
  - `pgrep(1)` much match the correct one!
  - `foobar2_flags`, `foobar2_user`...

- entry point
- where the whole framework is defined
- sourced by rc.d scripts
  - to get std functions and default vars
  - functions can be overridden by the script itself

```
${rcexec} "${daemon} ${daemon_flags} ${_bg}"
```

```
rcexec="su -l -c ${daemon_class} -s /bin/sh ${daemon_user} -  
c"
```

```
[ "${daemon_rtable}" -eq 0 ] || \
```

```
    rcexec="route -T ${daemon_rtable} exec ${rcexec}"
```

```
rc_bg=YES -> "&"
```

e.g.

```
su -l -c daemon -s /bin/sh root -c "/usr/sbin/sshd -flags"
```



```
pkill -T "${daemon_rtable}" -xf "${pexp}"
```

```
pexp="${daemon}${daemon_flags:+ ${daemon_flags}}"
```

At shutdown: base system daemons scripts are  
**not** run (SIGTERM)

```
pkill -HUP -T "${daemon_rtable}" \  
-xf "${pexp}"
```

```
pgrep -T "${daemon_rtable}" -q -xf "${pexp}"
```

- *start* will invoke rc\_pre() before starting a daemon
- pre-launch time requirements
  - e.g. create a directory to store a socket

- invoked by *stop* after a daemon process has been killed
- cleanup
  - remove dangling lock files
  - putting the system back into a pristine state (e. g. cups)

- main function
- last command called by an rc.d script
- 1 of 5 arguments

- check that the daemon is enabled
- check it is not already running
- run rc\_pre()
- run rc\_start()
- daemon variables in /var/run/rc.d/\${rcscriptname}
- wait up to \${daemon\_timeout} seconds

- check that the daemon is running
- run rc\_stop()
- wait up to `#{daemon_timeout}` seconds
- run rc\_post()
- `rm /var/run/rc.d/#{rcscriptname}`



- `/etc/rc.d/daemon stop`
- `/etc/rc.d/daemon start`

- check that the daemon is running
- run `rc_reload()`

- rc\_check()

- some daemons do not support an action
  - turn function into a variable set to “NO”
    - e.g. rc\_reload=NO

# The rc\_usercheck variable

- if rc\_check() requires higher privileges
  - rc\_usercheck=NO

- match currently running process in case configuration changed
- e.g. `/var/run/rc.d/ntpd`

```
daemon_class=daemon
```

```
daemon_flags=-s
```

```
daemon_rtable=0
```

```
daemon_timeout=30
```

```
daemon_user=root
```

```
pexp=/usr/sbin/ntpd
```

# full rc.d script template

```
daemon="/path/to/bin/foobar --daemonize"

#daemon_flags=
#daemon_rtable="0"
#daemon_timeout="30"
#daemon_user="root"

. /etc/rc.d/rc.subr

#pexp="${daemon}${daemon_flags:+ ${daemon_flags}}"

#rc_bg=
#rc_reload=
#rc_usercheck=YES
#rc_pre() { }
#rc_start() { ${rcexec} "${daemon} ${daemon_flags} ${_bg}" }
#rc_check() { pgrep -T "${daemon_rtable}" -q -xf "${pexp}" }
#rc_reload() { pkill -HUP -T "${daemon_rtable}" -xf "${pexp}" }
#rc_stop() { pkill -T "${daemon_rtable}" -xf "${pexp}" }
#rc_post() { }

rc_cmd $1
```

- rc.conf.local "editor" (sorting)
- configure & control daemons and services
- ala service(8) + chkconfig(8) + sysconfig
- syntax not compatible with service(8)
- alternative, not an \$EDITOR replacement



`multicast=YES`

`sshd=YES`

`multicast=`

`sshd_flags=`

`multicast_flags=NO`

`sshd_flags=NO`

- unified interface
- abstraction
- daemon versus service
- regular versus meta script
- rcctl support in Puppet, Ansible and Salt
  - puppet: 120 additions and 441 deletions

rcctl -> rc.subr -> rc.d script -> rc.conf+rc.conf.local  
-> rc.subr

- FUNCS\_ONLY=1
- from sourced to parsed: `_rc_parse_conf()`
- stop injecting shell code in dangerous places

```
usage: rcctl get|getdef|set service | daemon [variable [args]]
rcctl [-df] start|stop|restart|reload|check daemon ...
rcctl disable|enable|order [daemon ...]
rcctl ls all|failed|off|on|started|stopped
```

```
rcctl enable multicast messagebus cupsd
```

```
rcctl set ntpd flags -s
```

```
rcctl restart ntpd smtpd sshd
```

```
rcctl ls started
```

“rcctl ls failed” is run daily(8)

- ! replacement for the traditional BSD init
- ! process control framework
- ! service supervisor
- compromise
  - may not be suitable for all possible uses

- boringly simple and robust
- preserved the original paradigm
- built on decades-old components
- consistent and unified interface with rcctl
- easy integration into other OSes

Thank you for listening

Questions ?

Thank you BSDCan!

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**The OpenBSD Project**