Jail

frank

What is jail?

Lightweight container that isolate processes/ access to file system/network stack

- Introduced in FreeBSD 4.X
- Build upon the concept of chroot
- Operating-system-level virtualization

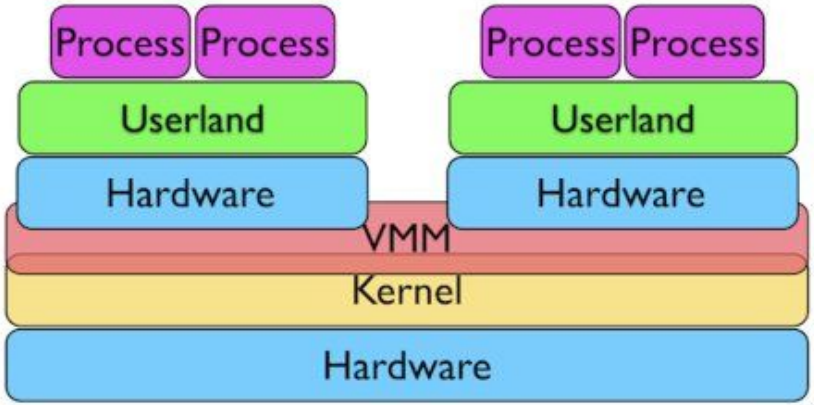
Jail v.s. chroot

Jails differs from chroot by the level of separation:

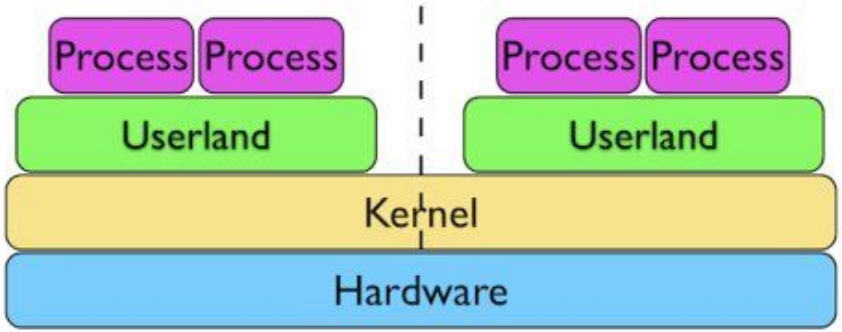
Chroot limits scope of filesystem for the process

While Jail isolates processes from the rest of system

Jail v.s. VM



VM



Jail

Jail: Advantage

Jail

- Easy to deploy and maintain
- Boot up fast (within seconds, while VM takes minutes)
- Much less overhead (Disk I/O, emulated NIC, CPU)

How to create a jail?

A jail is characterized by four elements:

- Path: the starting point from which jail is entered
- Hostname: Hostname used by jail
- IP address: IP assigned to the jail
- Command: the path name of executable to run inside the jail

How to create a jail?

Basic Jail Environment:

/myjail: place to put our jails, the *“Path”* of jail

/myjail/bin, /myjail/sbin: basic tools

/myjail/lib,/myjail/libexec: library dependencies

/myjail/dev: devfs

# jail -c **jid=1** name=myjail path=/myjail mount.devfs \
  ip4.addr=”127.0.0.1” host.hostname=myjail \
  command=”/bin/sh”

How to create a jail?

There must be at least one process attached to specific jail. Otherwise, set *persist* parameter.

jls // list running jails

When will a jail be destroyed?

Jail will be destroyed when no process is running in jail, unless *“persist”* is specified.

Jails with “persist” propertie may be destroyed manually using “jail -r <JID/Name>”

Create a jail with freebsd world

Download pre-built base system

fetch “http://ftp.tw.freebsd.org/pub/releases/amd64/10.1-RELEASE/base.txz”

mkdir /myjail // jail path

tar -xf base.txz -C /myjail // extract base into jail path

freebsd-update -b /myjail fetch install // upgrade base system

Create a jail with freebsd world

```
# jail -c name=myjail path=/myjail \
ip4.addr=vmx0|127.0.0.10/24 mount.devfs \
host.hostname=myjail.urcrazy.net \
exec.start=”sh /etc/rc” \
exec.stop=”sh /etc/rc.shutdown”
```

Managing Jails

Start jails upon system boot:

In rc.conf: jail_enable=”YES”

Saving jail configurations in /etc/jail.conf:

```
myjail {
        path=/myjail;
        mount.devfs;
        host.hostname=myjail.urcrazy.net;
        exec.start=”sh /etc/rc”;
        exec.shutdown=”sh /etc/rc.shutdown”;
        ip4.addr=”127.0.0.1”;
}
```

Managing Jails

Start/Stop all jails:

```
# service jail start/stop
```

Start/Stop specfic jails:

```
# service jail start/stop <jail name>
```

Managing multiple Jails

per jail base system:

- waste of space
- adds complexity to system adminstration

Solution?

Shared-base-system Jails

Managing multiple Jails

Common Implementation:

- Using ZFS
    - easy to backup/snapshot/clone

Managing multiple Jails using ZFS

Separate read-only and read-write areas

Read-write area:

- /usr/local
- /usr/X11R6
- /usr/home or /home
- /tmp
- /var
- /root
- /usr/ports/distfiles

Managing multiple Jails using ZFS

```
# cd /jail/basejail
# mv etc tmp var root ../skel
# mv usr/local ../skel/usr-local
# mkdir s
```

Managing multiple Jails using ZFS

```
# ln -s /s/etc etc
# ln -s /s/home home
# ln -s /s/root root
# ln -s /s/usr-local usr/local
# ln -s /s/usr-X11R6 /usr/X11R6
# ln -s /s/distfiles usr/ports/distfiles
# ln -s /s/tmp tmp
```

Managing multiple Jails using ZFS

```
# cd ../skel
# mkdir home usr-X11R6 distfiles
```

Managing multiple Jails using ZFS

for each jails:

create directory

/jail/${jail_name} and /jail/${jail_name}_rw

copy file in /jail/skel into /jail/${jail_name}_rw

cpdup /jail/skel/ /jail/${jail_name}_rw

Managing multiple Jails using ZFS

create individual fstab file fstab.${jail_name}

/jail/basejail /jail/${jail_name} nullfs ro 0 0
/jail/${jail_name}_rw /jail/${jail_name}/s nullfs rw 0 0

Managing multiple Jails using ZFS

Further simplify jail.conf using variables and wildcard

```
* {
        path=/jail/$name;
        mount.devfs;
        mount.fstab=/jail/fstab.$name;
        devfs_ruleset=4;
        host.hostname=$name.urcrazy.net;
        exec.start=”sh /etc/rc”;
        exec.shutdown=”sh /etc/rc.shutdown”;
}
```

```
jail01 {
        ip4.addr=”127.0.0.1”;
}

jail02 {
        ip4.addr=”127.0.0.2”;
}
```

Managing multiple Jails using ZFS

Recap

To create new jail:

1. create jail and jail_rw directory
2. copy /jail/skel/ into jail_rw directory
3. mount read-only basejail to jail directory
4. mount jail_rw to jail/s
5. do 2 and 3 with individual fstab file
6. add jail configuration into jail.conf

Managing Jail using tools

There are tools designed to aid jails managements

- qjail
- ezjail

Managing Jail using ezJail

pkg install ezjail

ezjail-admin install -p

To create jail

ezjail-admin create <jail name> <jail ip>

To list jail

ezjail-admin list

Managing Jail using ezJail

To enter jail console:

ezjail-admin console <jail name>

To create archive for jail

ezjail-admin archive <jail name>

To deploy jail from archive

ezjail-admin create -a <archive>

Jail Networking

Using NAT

ifconfig lo1 create

jail1 ip: lo1|10.0.0.1/24

jail2 ip: lo1|10.0.0.2/24

In rc.conf:

cloned_interfaces=”lo1”

Jail Networking

Using NAT

pf.conf:

```
ext_if=”vmx0”
jail_if=”lo1”

nat on $ext_if from $jail_if to any -> $ext_if
```

Jail Networking

Ping command returned

Operation not permitted

Solution:

allow.raw_sockets =1;

Fine tunning Jail

Jail has many restrictions, some of them can be tuned via setting sysctl and jail.conf parameters.

Make sure you know exactly what you’re doing

sysctl -d security.jail.param