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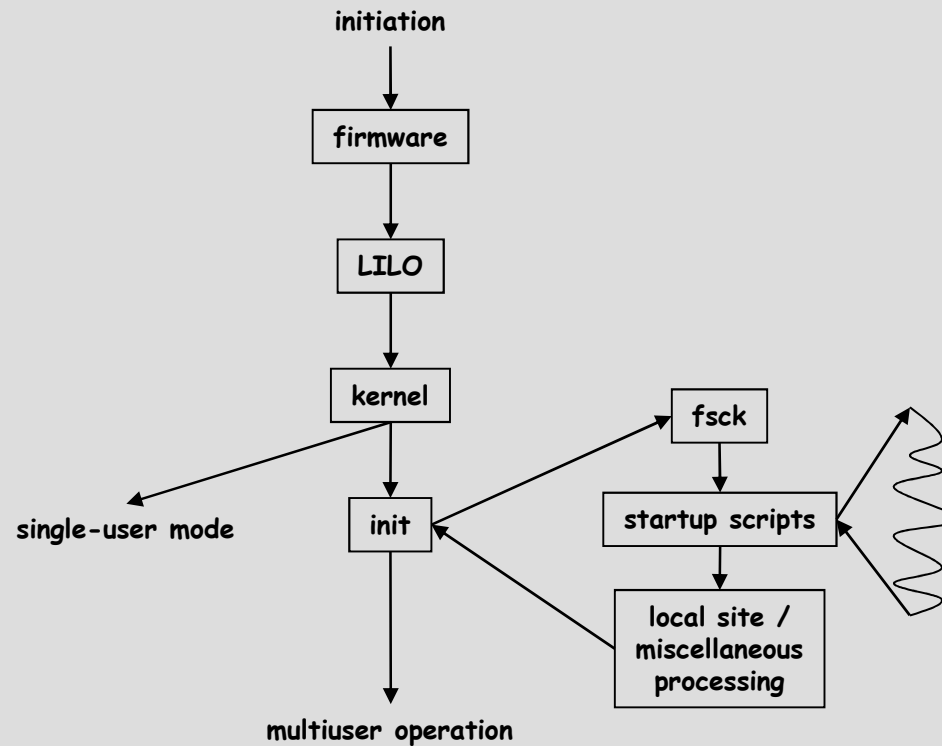
***System Startup and Shutdown***

**A**  
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***UNIX***

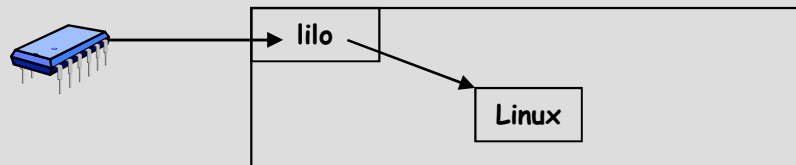
# Booting

- a multi-stage process
  - hardware (firmware) and software interact...



# The Linux Boot Loader 'Lilo'

- a versatile boot loader for Linux
  - does not depend on a specific file system, can boot Linux kernel images from floppy disks and from hard disks and can even act as a "boot manager" for other operating systems
- typically installed into the master boot record of the system disk
  - boot ROM program will load whatever it finds in the MBR and transfer execution to the loaded image



- configured in `/etc/lilo.conf`

```

boot=/dev/hda
map=/boot/map
install=/boot/boot.b
prompt
timeout=50
image=/boot/vmlinuz-2.0.36-1
    label=linux
    root=/dev/hda1
    initrd=/boot/initrd-2.0.36-1.img
    read-only
image=/boot/vmlinuz-2.0.36-0.7
    label=linux.old
    root=/dev/hda1
    initrd=/boot/initrd-2.0.36-0.7.img
    read-only
    
```

# Init

- **process #1—ancestor of all other processes**
  - may be found in /bin, /etc, /sbin or various other places
  - kernel will search and execute the first version that it finds

```
# pstree -a
init
|-atd
|-crond
|-getty ttyS0 DT19200 vt100
|-gpm -t PS/2
|-httpd -f /etc/httpd/conf/httpd.conf
|   |-httpd -f /etc/httpd/conf/httpd.conf
|   `--httpd -f /etc/httpd/conf/httpd.conf
|-inetd
|   `--in.telnetd
|       `--login -h aunty -p
|           `--tcsh
|               `--pstree -a
|-kernelld
|-(kflushd)
|-klogd
|-(kswapd)
|-lpd
|-(md_thread)
|-(md_thread)
|-mingetty tty1
|-mingetty tty2
|-nmbd -D
|-smbd -D
|-syslogd
`-update
```

- **a major differentiating feature between SysV and BSD versions**
  - SysV mechanism 'winning'
    - *more flexible, clearer configuration mechanism*

# Inittab

- **operation parameterized via /etc/inittab**
  - defines a number of runlevels and the activities that should be performed when a runlevel is entered

```
# label:runlevels:action:process
id:3:initdefault:

si::sysinit:/etc/rc.d/rc.sysinit

10:0:wait:/etc/rc.d/rc 0
11:1:wait:/etc/rc.d/rc 1
12:2:wait:/etc/rc.d/rc 2
13:3:wait:/etc/rc.d/rc 3
14:4:wait:/etc/rc.d/rc 4
15:5:wait:/etc/rc.d/rc 5
16:6:wait:/etc/rc.d/rc 6

ud::once:/sbin/update

ca::ctrlaltdel:/sbin/shutdown -t3 -h now

pf::powerfail:/sbin/shutdown -f -h +2 "Power Failure; System Shutting Down"
pr:12345:powerokwait:/sbin/shutdown -c "Power Restored; Shutdown Cancelled"

1:12345:respawn:/sbin/mingetty tty1
2:3:respawn:/sbin/getty ttyS0 DT19200 vt100
3:3:respawn:/sbin/mingetty tty2

x:5:respawn:/usr/bin/X11/xdm -nodaemon
```

- **telinit command**
  - used to tell init to switch to another runlevel

```
# telinit S
```
  - telinit is simply a symbolic link to init for convenience

# System Runlevels

- **init starts the shell script `/etc/rc.d/rc`**
  - **this then looks in a subdirectory `rcn.d`**
    - *n corresponds to the runlevel being entered*
    - *directory is full of symbolic links to scripts in `/etc/rc.d/init.d`*
      - *each real script in `/etc/rc.d/init.d` is responsible for controlling a single startup procedure*
        - *e.g. `httpd`*
    - *two categories of link*
      - *Slink*
        - *responsible for starting a procedure*
        - *e.g. `S10http`*
      - *Klink*
        - *undoes the activities of the Slink*
        - *e.g. `K10http`*
    - *two-digit number provides for ordering of startup process*
    - *both Slink and Klink links refer to the same script*
    - *rc deals with starting and stopping each procedure*
      - *rc will pass the parameter 'start' to an Slink and 'stop' to a Klink*
        - *`S10httpd start`*

• *(see p111, Frisch)*

# */etc/rc.d*

```
# tree /etc/rc.d
/etc/rc.d
|-- init.d
|   |-- atd
|   |-- crond
|   |-- functions
|   |-- gpm
|   |-- halt
|   |-- httpd
|   |-- httpd-
|   |-- inet
|   |-- kernel
|   |-- kernel
|   |-- keytable
|   |-- killall
|   |-- lpd
|   |-- network
|   |-- nfsfs
|   |-- pcmcia
|   |-- random
|   |-- routed
|   |-- rusersd
|   |-- rwhod
|   |-- sendmail
|   |-- single
|   |-- smb
|   |-- sound
|   `-- syslog
|-- rc
|-- rc.local
|-- rc.sysinit
|-- rc3.d
|   |-- K20rusersd -> ../init.d/rusersd
|   |-- K20rwhod -> ../init.d/rwhod
|   |-- K55routed -> ../init.d/routed
|   |-- S01kernel -> ../init.d/kernel
|   |-- S10network -> ../init.d/network
|   |-- S15nfsfs -> ../init.d/nfsfs
|   |-- S15sound -> ../init.d/sound
|   |-- S20random -> ../init.d/random
|   |-- S30syslog -> ../init.d/syslog
|   |-- S40atd -> ../init.d/atd
|   |-- S40crond -> ../init.d/crond
|   |-- S45pcmcia -> ../init.d/pcmcia
|   |-- S50inet -> ../init.d/inet
|   |-- S60lpd -> ../init.d/lpd
|   |-- S75keytable -> ../init.d/keytable
|   |-- S85gpm -> ../init.d/gpm
|   |-- S85httpd -> ../init.d/httpd
|   |-- S91smb -> ../init.d/smb
|   `-- S99local -> ../rc.local
```

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UNIX

# Configuration Script

```
# /etc/rc.d/init.d/httpd

# Source function library.
. /etc/rc.d/init.d/functions

# See how we were called.
case "$1" in
    start)
        echo -n "Starting httpd: "
        daemon httpd -f /etc/httpd/conf/httpd.conf
        echo
        touch /var/lock/subsys/httpd
        ;;
    stop)
        echo -n "Shutting down http: "
        [ -f /var/run/httpd.pid ] && {
            kill `cat /var/run/httpd.pid`
            echo -n httpd
        }
        echo
        rm -f /var/lock/subsys/httpd
        rm -f /var/run/httpd.pid
        ;;
    status)
        status httpd
        ;;
    restart)
        $0 stop
        $0 start
        ;;
    reload)
        echo -n "Reloading httpd: "
        [ -f /var/run/httpd.pid ] && {
            kill -HUP `cat /var/run/httpd.pid`
            echo -n httpd
        }
        echo
        ;;
    *)
        echo "Usage: $0 {start|stop|restart|reload|status}"
        exit 1
esac

exit 0
```

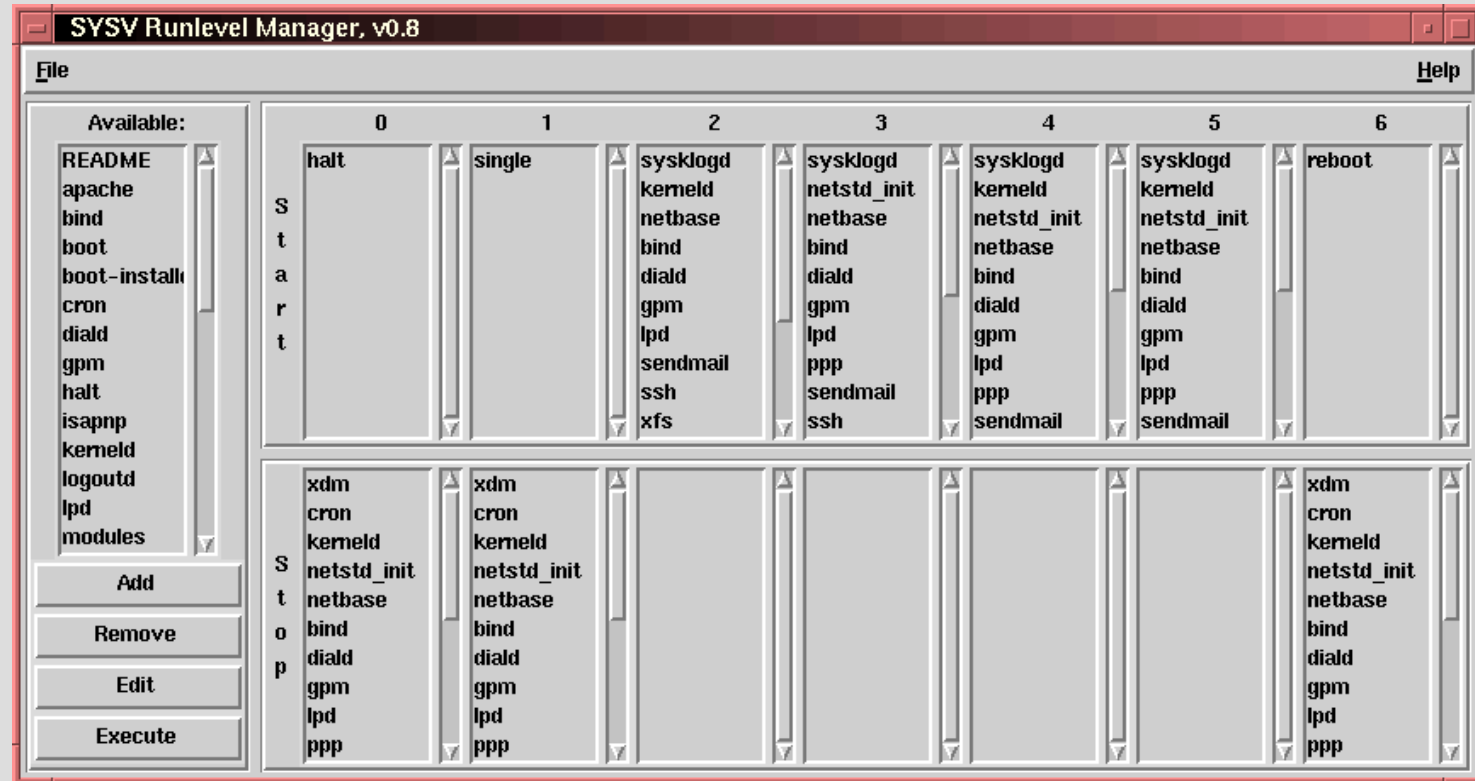
\$  
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# Tksysv



SVN

Monday, June 22, 2009

Adrian

Unix

# Single-User Mode

- after init has started it can place the system in single user mode instead of completing the processing of `/etc/inittab`
  - single user mode is designed for administration/maintenance
    - *no filesystems mounted (except for the root filesystem)*
    - *minimal set of processes running*
- can bring a system down to single-user mode by
- the system may enter single user mode itself if it encounters problems during boot
  - e.g. fsck finds unfixable filesystem errors
- can cause Linux to boot single mode

`telinit S`

`LILO boot: linux single`

# Checking Filesystem Integrity

- /sbin/fsck
  - started from /etc/rc.d/rc.sysinit
  - ensures that disk data structures are correct
  - actually a front-end for filesystem-specific checkers
    - *e2fsck, fsck.minix, etc.*
  - run at each boot under BSD, only every *n*th boot under SysV
    - *so SysV boots are typically faster (but a little less robust?)*
  - if errors found, little that you can do other than `fsck -p -y`!
    - `-p: 'preen'`
    - `-y: answer 'yes' to every question fsck asks`
      - will save lost blocks in `lost+found` directory in root of filesystem
        - made by `/usr/sbin/mklost+found` when the filesystem is made
  - won't check a filesystem if `/etc/fastboot` exists
  - chicken-and-egg problem:
    - *executing files from an unchecked filesystem*
      - may be dangerous
    - *several approaches to this problem*
      - have the kernel check the root filesystem before anything else
      - ignore: if the kernel has started and `init` is running, things are probably OK
      - restart `init` once the filesystem has been checked, so that the system is working with processes known to be good

# Starting *fsck*

```
# excerpted from /etc/rc.d/rc.sysinit
if [ -f /fsckoptions ]; then
    fsckoptions=`cat /fsckoptions`
else
    fsckoptions=''
fi

if [ ! -f /fastboot ]; then
    echo "Checking root filesystems."
    fsck -V -a $fsckoptions /

    rc=$?

    # A return of 2 or higher means there were serious problems.
    if [ $rc -gt 1 ]; then
        echo
        echo
        echo "**** An error occurred during the file system check."
        echo "**** Dropping you to a shell; the system will reboot"
        echo "**** when you leave the shell."

        PS1="(Repair filesystem) \#"; export PS1
        sulogin

        echo "Unmounting file systems"
        umount -a
        mount -n -o remount,ro /
        echo "Automatic reboot in progress."
        reboot
    elif [ "$rc" = "1" -a -x /sbin/quotacheck ]; then
        echo "Checking root filesystem quotas"
        /sbin/quotacheck -v /
    fi
fi
```

# Fsck Output

```
# fsck /scratch1 -f
Parallelizing fsck version 1.10 (24-Apr-97)
e2fsck 1.10, 24-Apr-97 for EXT2 FS 0.5b, 95/08/09
Pass 1: Checking inodes, blocks, and sizes
Pass 2: Checking directory structure
Pass 3: Checking directory connectivity
Pass 4: Checking reference counts
Pass 5: Checking group summary information
/dev/sdal: 11/5136 files (0.0% non-contiguous), 668/20464 blocks
```

```
/dev/usr
Fast File System: Volume:
** Phase 1 - Check Blocks and Sizes
POSSIBLE FILE SIZE ERROR I=7233
** Phase 2 - Check Pathnames
** Phase 3 - Check Connectivity
** Phase 4 - Check Reference Counts
UNREF FILE I=4612 OWNER=root MODE=20000
SIZE=0 MTIME=Nov 18 06:26:47 1991
CLEAR?y Answering yes may remove files.
```

# Checking Filesystem Integrity

- `/etc/fstab`
  - used to tell `fsck` which filesystems to check
  - in what order
    - can check filesystems in parallel
  - also used by `mount` and `umount` commands

<code>/dev/hda1</code>	<code>/</code>	<code>ext2</code>	<code>defaults</code>	<code>1 1</code>
<code>/dev/sdb1</code>	<code>/home</code>	<code>ext2</code>	<code>defaults</code>	<code>1 2</code>
<code>/dev/sdb5</code>	<code>/usr</code>	<code>ext2</code>	<code>defaults</code>	<code>1 2</code>
<code>/dev/hda6</code>	<code>/var</code>	<code>ext2</code>	<code>defaults</code>	<code>1 2</code>
<code>/dev/hda5</code>	<code>swap</code>	<code>swap</code>	<code>defaults</code>	<code>0 0</code>
<code>/dev/fd0</code>	<code>/mnt/floppy</code>	<code>ext2</code>	<code>noauto</code>	<code>0 0</code>
<code>/dev/sda1</code>	<code>/scratch1</code>	<code>ext2</code>	<code>defaults</code>	<code>1 2</code>
<code>/dev/sda2</code>	<code>/tmp</code>	<code>ext2</code>	<code>defaults</code>	<code>1 2</code>
<code>/dev/cdrom</code>	<code>/mnt/cdrom</code>	<code>iso9660</code>	<code>noauto,ro</code>	<code>0 0</code>
<code>none</code>	<code>/proc</code>	<code>proc</code>	<code>defaults</code>	<code>0 0</code>

device

mount point

filesystem type

mount options

dump frequency

fsck pass

# BSD-Style Initialization

- simple version of the SysV mechanism
- inittab plays a more important role
- /etc/rc.boot then /etc/rc and /etc/rc.local
  - may be other files
  - BSD-style initialization is actually very individual to each version of UNIX

# Other Startup Activities

- there is a lot more that needs to be done...
  - starting system swapping
    - */sbin/swapon*
  - clear /tmp
    - *to save space*
    - *especially need to remove old copies of passwd files*
      - may have been being edited when the system went down
  - quotas/accounting, etc.
    - */sbin/quotaon*
    - */usr/sbin/accton*
  - network initialization
    - */sbin/ifconfig*
  - mounting filesystems
    - */bin/mount*
  - logging to the message buffer, thence /var/log/messages
  - starting terminal services
    - */sbin/getty*
  - site-specific work can be performed in /etc/rc.d/rc.local



# Shutting The System Down

- **/sbin/shutdown**

# /sbin/shutdown -h +5 "System going down in 5 minutes. You have been warned!"

- main way of shutting the system down
  - *either immediately or after a delay*
- can notify all logged-in users
  - *can specify the message they are sent*
  - *users will be warned more often as shutdown time approaches*
- prevents new logins
- calls /bin/sync
- calls either /sbin/halt or /sbin/reboot

- **/bin/sync**

- flushes memory write-buffers to disk

- **/sbin/halt, /sbin/reboot**

- "quick and dirty" mechanisms
- same as telinit 0 or telinit 6, respectively
- probably should not be used directly
  - *especially for multiuser systems*