C²S CONSULTING

GNU/Linux Basic Part 2

FREE TECHNOLOGY ACADEMY

Diarmuid Ó Briain
CEng, FIEI, FIET, CISSP

diarmuid@obriain.com

creative commons

This material is under a Creative Commons BY-SA 3.0 license
Full license: http://creativecommons.org/licenses/by-sa/3.0/

GNU/Linux Basic operating system

These slides are designed to follow the text book

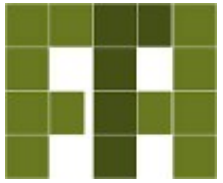
Joaquín López Sánchez-Montañés
Sofia Belles Ramos
Roger Baig Viñas
Francesc Aulí Llinàs

Jordi Serra i Ruiz (coordinator)
David Megías Jiménez (coordinator)
Jordi Mas (coordinator)

Diarmuid Ó Briain (Slide deck)

http://www.ftacademy.org

Table of Content



- **Free Software (a.k.a. Open Source)**
- **Basic concepts and commands**
- **Knoppix workshop**
- **Debian installation workshop**
- **Basic configurations**
- **Daemons and runlevels**
- Installation of applications
- Workshop on basic configurations
- X-Window architecture
- X-Window workshop

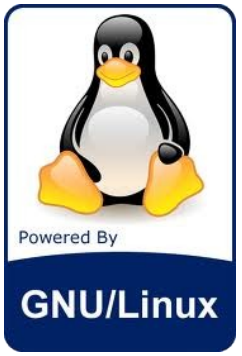
C²S CONSULTING

GNU/Linux Installation

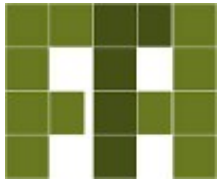
Diarmuid Ó Briain
CEng, FIEI, FIET, CISSP

diarmuid@obriain.com

FREE TECHNOLOGY ACADEMY

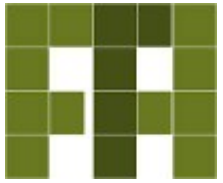


Preparation to install Linux



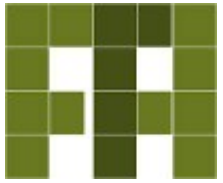
- Before starting with the installation process it is convenient to know the brand and model of:
  - Graphic and sound card installed on the computer.
  - Network card.
  - Brand, type and characteristics of the monitor.
  - Any other special hardware that we have.
- Generally, for the motherboard, the CPU and the RAM, we do not need to know their characteristics.

Booting



- ISO image on CD/DVD or USB Stick.
- Network installation.
- Installation steps:
  - Type of installation.
  - Language.
  - Keyboard.
  - Network.
  - Disk partitioning.
  - Time zone.
  - Clock settings.
  - Users and passwords.
  - Software selection, required application suites.

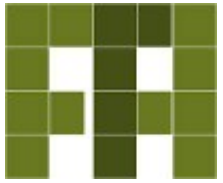
Disk partitions



- Although with one or two partitions we would have enough to be able to install GNU/Linux, it is interesting to divide the disk into more fragments and to place certain directories in different units so that we can manage the resources more efficiently, avoid system crashes due to disk saturation etc.
- It is advisable for GNU/Linux to use a minimum of two hard disk partitions. One will for the system files and the other for SWAP.
  - Swap is an exchange zone between the computer's RAM and the hard disk.
  - advise making SWAP double the size of RAM (if RAM < 64 MB), and the same as RAM if > 64 MB.

```
$ free
             total       used       free     shared    buffers     cached
Mem:       7738624    3688396    4050228          0     109076    2418812
-/+ buffers/cache:    1160508    6578116
Swap:      7942140          0    7942140
```

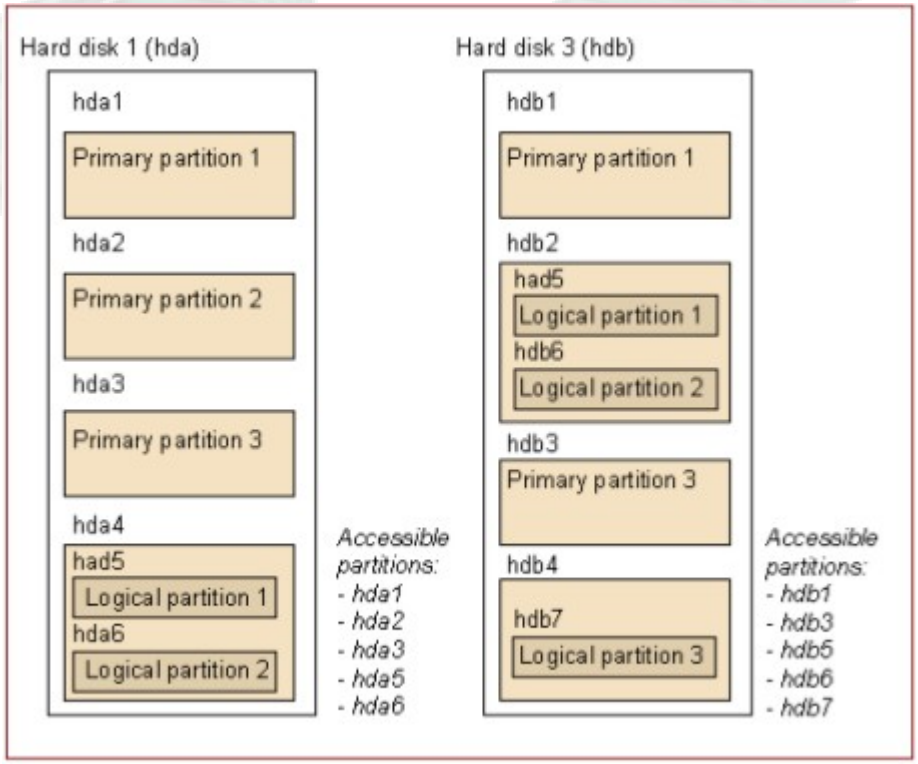
Hard Disk Devices



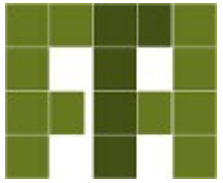
- Primary Master IDE /dev/hda
- Primary Slave IDE /dev/hdb
- Secondary Master IDE /dev/hdc
- Secondary Slave IDE /dev/hdd
- First SCSI drive /dev/sda
- Second SCSI drive /dev/sdb
- Third SCSI drive /dev/sdc

Hard Disk Devices

- When creating a partition, the file system must be specified (Linux ext2, ext3, ext4 or Linux swap).
- The partition that will contain the root partition and the Master Boot Record (MBR) are defined.

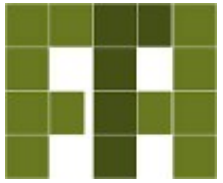


Partition Types



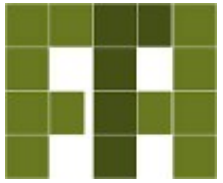
- Primary partition
  - Maximum of 4, Minimum of 1
  - /dev/hda1, /dev/hda2, /dev/hda3, /dev/hda4
- Extended Partition
  - Only 1 can exist on a physical disk
  - If exists it takes a Primary partition name
  - /dev/hda1 (Primary), /dev/hda2 (extended)
- Logical Partition
  - Logical partitions exist within an extended partition
  - Numbered from 5 to 16
  - /dev/hda5, /dev/hda6, /dev/hda7 …..

Installation of modules



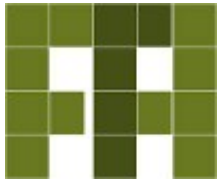
- Kernel modules – software specialised for particular task.
- Saves the need to re-compile kernel if not included.
- If we forget to include a module, or install some new device at the time of installation, we can always use the following commands:
  - **`insmod`** - to add a new module.
  - **`lsmod`** - to list the modules installed.
  - **`rmmod`** - to eliminate a module.
  - **`modprobe`** - to test one, and if it works correctly, include it in the kernel.
- All of these modules are no more than binary files that we tend to find in the system's **`/lib/modules/`** directory.
- Modules configuration file is fond in **`/etc/modules/`** directory.

Network



- System name.
- DHCP, BOOTP or Static addressing.
- Static:
  - IP Address.
  - Subnet mask.
  - Default Gateway.
  - Domain name server (DNS).

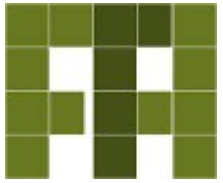
Boot system



- LInux LOader (LILO)
  - Boot loader for Linux and was the default boot loader for most Linux distributions in the years after the popularity of loadlin.
  - Today, most distributions use GRUB as the default boot loader.

- GNU GRand Unified Bootloader (GNU GRUB)
  - Boot loader package from the GNU Project.
  - Multiboot Specification, which provides a user the choice to boot one of multiple operating systems installed on a computer or select a specific kernel configuration available on a particular operating system's partitions.

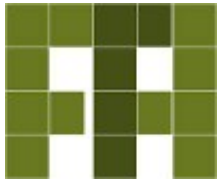
Package Groups



- During the installation the distribution will give package group options to install.

```
Choose software to install:

[■] Desktop Environment
[ ] Web server
[ ] Print server
[ ] DNS server
[ ] File server
[ ] Mail server
[ ] SQL database
[ ] Manual package selection
```

Package selection – apt / yum



- Advanced Packaging Tool (APT)
- Aptitude, front-end for APT.

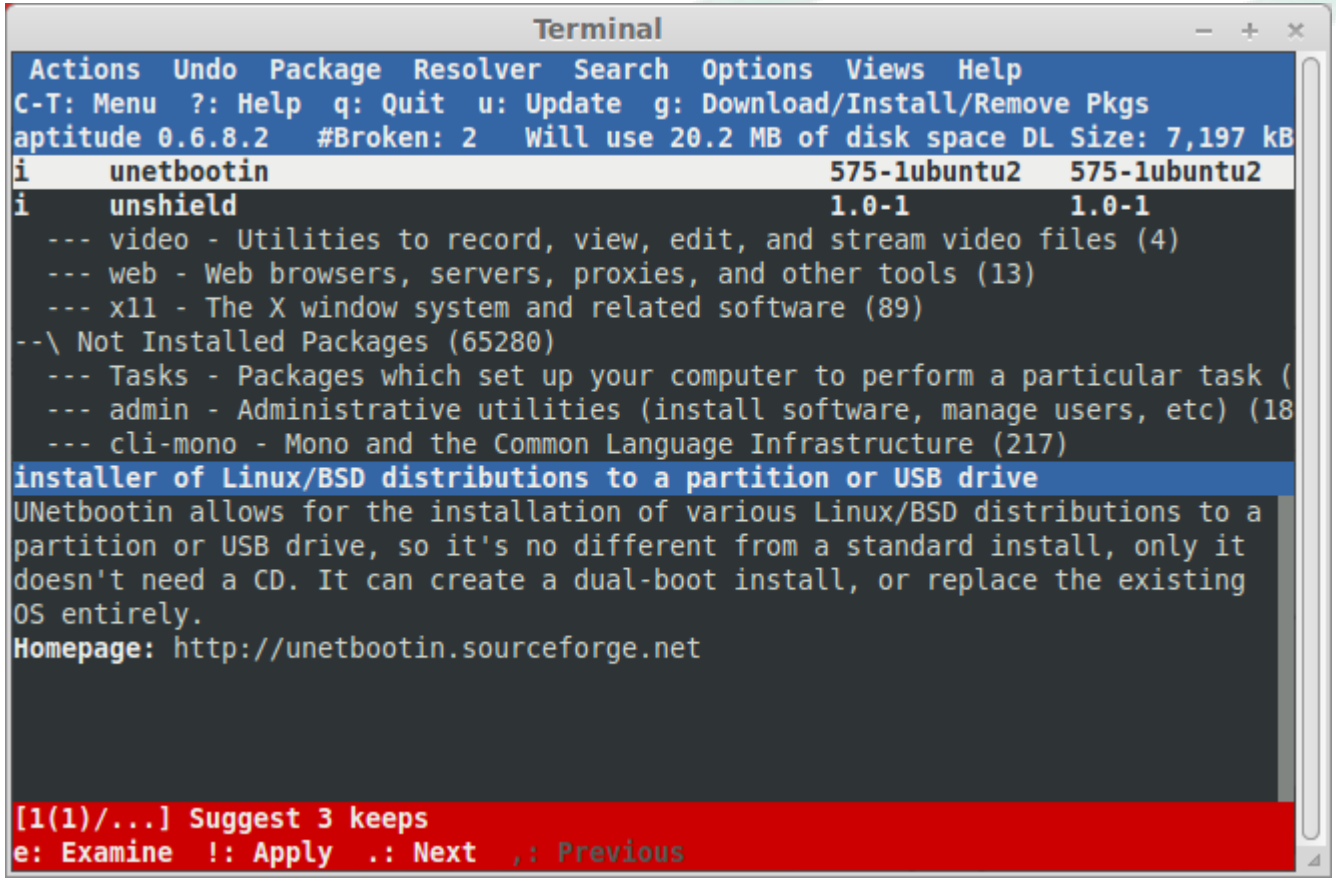
```
$ apt-cache search unetbootin
unetbootin - installer of Linux/BSD distributions to a partition or USB drive
unetbootin-translations - translations for the unetbootin distribution installer

$ sudo apt-get install unetbootin
```

- Yellowdog Updater, Modified (YUM)

```
$ yum search unetbootin
unetbootin - installer of Linux/BSD distributions to a partition or USB drive
unetbootin-translations - translations for the unetbootin distribution installer

$ sudo yum install unetbootin
```

Package selection – aptitude

- Aptitude, front-end for APT.



C²S CONSULTING

Debian installation workshop

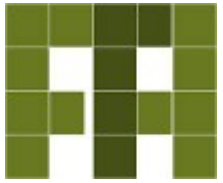
Diarmuid Ó Briain
CEng, FIEI, FIET, CISSP

diarmuid@obriain.com

FREE TECHNOLOGY ACADEMY

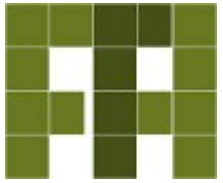
Powered by debian GNU/Linux

Debian - Types of packages



- Main
  - Packages that comply with the Debian free software guidelines, in other words, free use and redistribution of all the binaries comprising them, in addition to their complete source code, is guaranteed.
- Contrib
  - Packages that, while free and therefore like the binaries have their source code available, depend on other packages that are not.
- Non-free
  - Packages that although they may be free of charge, have restrictive conditions that in some way limit their use or redistribution.
- non-US/main
  - The packages of this area are free themselves, but cannot be exported from a server in the US.
- non-US/non-free
  - Packages that cannot be exported from the US because they contain ciphered software or software that can affect issues relating to patents.

Debian – Package development status



- Stable
  - The most recent official version of the Debian GNU/Linux distribution. It consists of stable well-tested software and changes only to incorporate important security or usability corrections.
- Testing
  - Distribution that contains the packages expected to become part of the next stable distribution. There are a series of very strict requirements that each package must fulfil before moving from unstable to testing. Testing does not have the security team's updates at the same time as they are released.
- Unstable
  - This distribution includes the most recent Debian packages, and consequently, the least tested. Therefore, they can contain serious enough problems to affect the system's stability.

Installing Debian

Booting Debian

C²S CONSULTING

Basic Configurations

Diarmuid Ó Briain
CEng, FIEI, FIET, CISSP

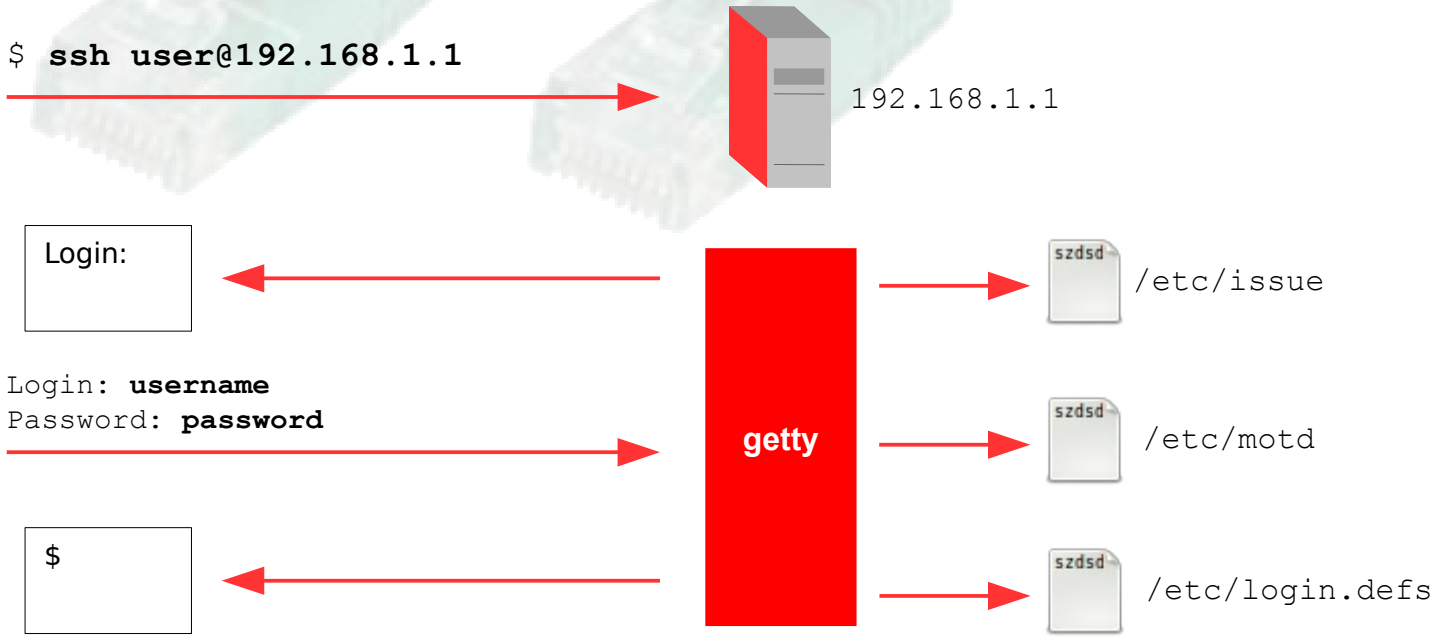
diarmuid@obriain.com

FREE TECHNOLOGY ACADEMY

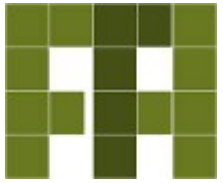
Powered by debian GNU/Linux

Login system

- "**get teletype**" (getty)
  - Program running on Linux that manages physical or virtual terminals (TTY).
  - When a connection is detected, it prompts for a username and runs the 'login' program to authenticate the user. I
  - It is usually called by init, the Linux initialisation process.



Login system - /etc/issue /etc/motd



```
$ ssh dobriain@MyDebianServer
dobriain@MyDebianServer's password:
Linux debian-OB 3.11.6-x86_64-pae #1 SMP Wed Oct 23 15:24:17 EDT 2013 x86_64

$ cat /etc/issue
Debian GNU/Linux 7 \n \l

$ cat /etc/motd

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
```

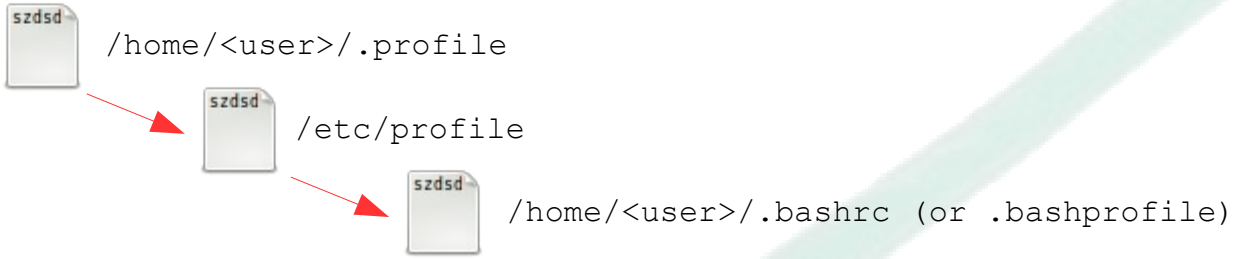
\s	Name of the operating system
\l	Console number
\m	Computer architecture
\n	Name of the computer
\o	Name of the domain
\r	Operating system version
\t	Current time
\u	Number of active users on the system

- To suppress the /etc/motd for a particular user, create an empty file in the users home directory.

/home/<user>/.hushlogin

```
$ touch /home/dobriain/.hushlogin
Debian GNU/Linux 7 \n \l
```

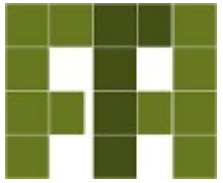
Profile



\d	System date
\h	Name of the machine
\s	Shell that we use
\u	Username
\v	Bash version
\w	Current directory

```
$ cat ~/.profile
# ~/.profile: executed by the command interpreter for login shells.
# This file is not read by bash(1), if ~/.bash_profile or ~/.bash_login
# exists.
# see /usr/share/doc/bash/examples/startup-files for examples.
# the files are located in the bash-doc package.

# the default umask is set in /etc/profile; for setting the umask
# for ssh logins, install and configure the libpam-umask package.
#umask 022

# if running bash
if [ -n "$BASH_VERSION" ]; then
    # include .bashrc if it exists
    if [ -f "$HOME/.bashrc" ]; then
        . "$HOME/.bashrc"
    fi
fi

# set PATH so it includes user's private bin if it exists
if [ -d "$HOME/bin" ] ; then
    PATH="$HOME/bin:$PATH"
fi
```

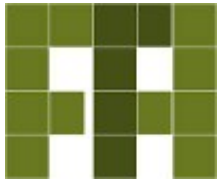
PATH



- The PATH is the directories where the commands, programs, applications etc., that may need to be called from any place within the file system hierarchy without having to write the full path.
  - To execute the programs from the directory without having to place "./" at the beginning, one could add this entry to the PATH declaration.
  - Likewise, if the PATH does not have the program that is needed to execute, its full path can be specified in the command line.
  - It is not advisable to add "./" to the PATH because it can become a security hole.

```
$ echo $PATH
/usr/local/bin:/usr/bin:/bin:/usr/local/games:/usr/games

$ sudo -s
[sudo] password for dobriain: <password>

# echo $PATH
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin
```

alias



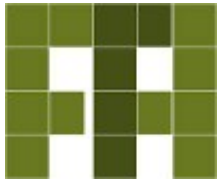
- The alias command allows the user to create shortcut commands to mimic functionality of another command i.e.

```
$ ls
MyFile  MyFile1  MyFile2  MyFile3  MyFile-conference
```

- Each time I use the `ls` command I really wanted to do `ls -la` with colour so I created an alias for `lls` which is `ls -ls --color=auto`.

```
$ alias lls='ls -ls --color=auto'
$ lls
total 28
4 -rwxr-xr-x 1 dobriain dobriain   46 Jan  2 13:53 MyFile
8 -rw-r--r-- 1 dobriain dobriain 5965 Jan  2 13:53 MyFile1
8 -rw-r--r-- 1 dobriain dobriain 5998 Jan  2 13:53 MyFile2
4 -rw-r--r-- 1 dobriain dobriain   44 Jan  2 13:53 MyFile3
4 -rw-r--r-- 1 dobriain dobriain  859 Jan  2 13:53 MyFile-conference
```

unalias

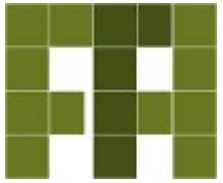


- I can remove this alias with the unalias command

```
$ alias
alias grep='grep --colour=auto'
alias ll='ls -al'
alias lls='ls -ls --color=auto'
alias ls='ls --color=auto'

$ unalias lls

$ alias
alias grep='grep --colour=auto'
alias ll='ls -al'
alias ls='ls --color=auto'
```

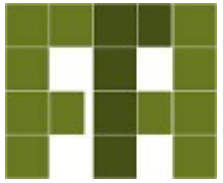
- This is ideal for small commands like this and if I add the alias to the /etc/profile of my local ~/.profile to make it available each time I login.

Enviornment variables



- PWD: current directory.
- BASH_VERSION: bash version that we are using.
- RANDOM: generates a different random number every time we display its content.
- SHELL: The users shell
- SECONDS: number of seconds that have passed since we opened the shell.
- HOSTNAME: system name.
- OSTYPE: type of operating system that we are using.
- MACHTYPE: computer architecture.
- HOME: user's home directory.
- HISTFILESIZE: size of the history file (number of commands that are saved).
- HISTCMD: number of the current command in the history.
- HISTFILE: file where the command history is saved (in general, .bash history the user's home directory).

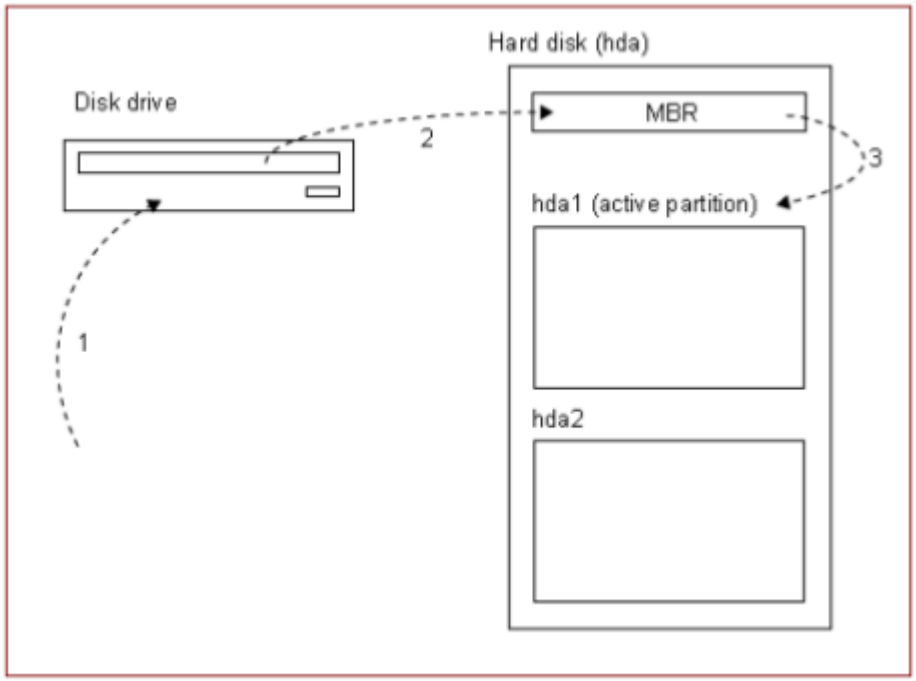
Enviornment variables



```
$ echo $BASH_VERSION
4.2.45(1)-release
$ echo $HOSTNAME
riomhairePAD
$ echo $OSTYPE
linux-gnu
$ echo $RANDOM
5158
$ env
XDG_VTNR=7
SSH_AGENT_PID=1838
XDG_SESSION_ID=c1
GPG_AGENT_INFO=/run/user/1000/keyring-0mQXCE/gpg:0:1
TERM=xterm
SHELL=/bin/bash
VTE_VERSION=3406
XDG_SESSION_COOKIE=84273682289cb92af8f07c1052ab3664-1388652461.572695-163
7737138
CLUTTER_DISABLE_XINPUT=1
GJS_DEBUG_OUTPUT=stderr
~~~~~~~~~~~~~~~~~~~~~~
```

- `env` - command lists all the user enviornment variables.

The boot system



hda = hd0
hdb = hd1

hda1 = hd0,0
hda2 = hd0,1

hdb1 = hd1,0
hdb2 = hd1,1

- When the computer is turned on its Basic Input/Output System (BIOS) give the boot order.
- The Disk drive.
- Inspect the MBR of the first IDE channel or first diak of SCSI channel.
- GRUB or LILO manages the Operating System boot from there.

Boot system - GRUB

Operating System boot option menu

- GNU GRand Unified Bootloader (GRUB)
- Multiboot Boot loader

Stage 2 — /boot/grub — Volume boot record

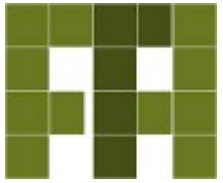
diskboot.img

Stage 1.5 — core.img — Empty sectors #34-x

GPT Header — GUID Partition Table sector #1

Stage 1 — boot.img — Master Boot Record sector #0

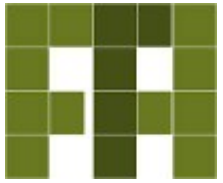
Kernel boot time messages



- While Linux boots it logs detailed messages of the process in the kernel ring buffer. These messages can be retrived by use of the ‘dmesg’ command. Typically these messages give good information if the system is having boot problems.

```
$ dmesg > boot.log
$ head boot.log
[    0.000000] Initializing cgroup subsys cpuset
[    0.000000] Initializing cgroup subsys cpu
[    0.000000] Linux version 3.2.0-4-686-pae
(debian-kernel@lists.debian.org) (gcc version 4.6.3 (Debian 4.6.3-14) )
#1 SMP Debian 3.2.51-1
[    0.000000] Disabled fast string operations
[    0.000000] BIOS-provided physical RAM map:
[    0.000000]  BIOS-e820: 0000000000000000 - 000000000009f000 (usable)
[    0.000000]  BIOS-e820: 000000000009f000 - 00000000000a0000 (reserved)
[    0.000000]  BIOS-e820: 0000000000100000 - 000000003ffd8000 (usable)
[    0.000000]  BIOS-e820: 000000003ffd8000 - 0000000040000000 (reserved)
[    0.000000]  BIOS-e820: 00000000e0000000 - 00000000f0007000 (reserved)
```

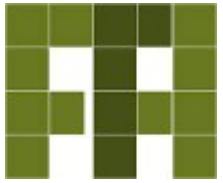
System logs



- More information can be retrived from the system logs like `/var/log/messages`

```
$ sudo head -n5 /var/log/messages
Jan  2 14:25:10 debian-OB kernel: imklog 5.8.11, log source = /proc/kmsg started.
Jan  2 14:25:10 debian-OB rsyslogd: [origin software="rsyslogd"
swVersion="5.8.11" x-pid="2128" x-info="http://www.rsyslog.com"] start
Jan  2 14:25:10 debian-OB kernel: [    0.000000] Initializing cgroup subsys
cpuset
Jan  2 14:25:10 debian-OB kernel: [    0.000000] Initializing cgroup subsys cpu
Jan  2 14:25:10 debian-OB kernel: [    0.000000] Linux version 3.2.0-4-686-pae
(debian-kernel@lists.debian.org) (gcc version 4.6.3 (Debian 4.6.3-14) ) #1 SMP
Debian 3.2.51-1
```

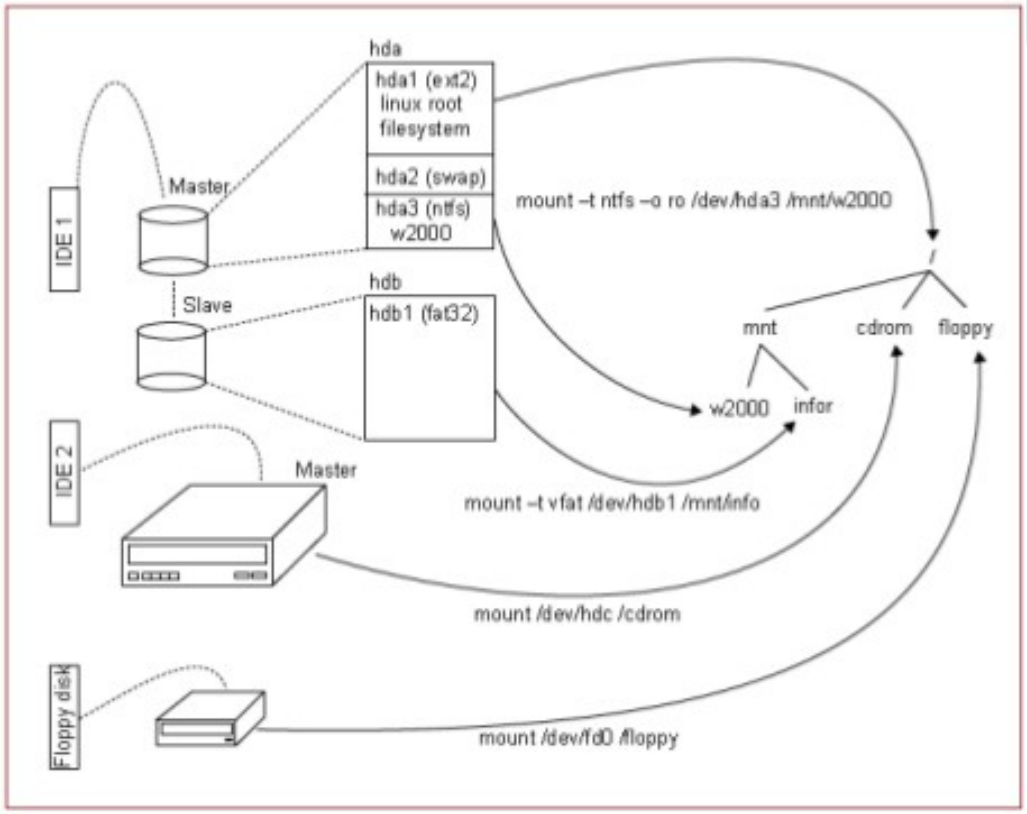
Mounting and Un-mounting



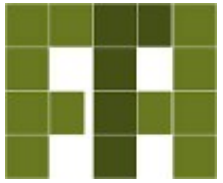
- In order to make a file system accessible, it's assigned to a particular directory in another file system.
- A directory in one file system which contains another file system is known as a *mount point*.
- A mount point is a directory in a first file system on one device (such as your hard disk) but which contains a second file system, perhaps on another device (such as a floppy disk).
- To access a file system, you must mount it at some mount point.

mount

- Devices are mounted to directories in the filesystem.
- Devices are accessed just like directories.

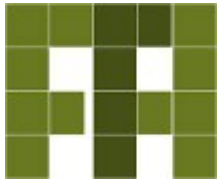


/etc/fstab



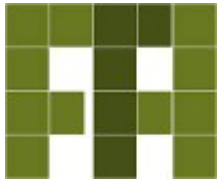
- The file `fstab` contains descriptive information about the various file systems.
- `fstab` is only read by programs, and not written to; it is the duty of the system administrator to properly create and maintain this file.
- Each filesystem is described on a separate line; fields on each line are separated by tabs or spaces.
- The order of records in fstab is important because fsck, mount, and umount sequentially iterate through `/etc/fstab`.

/etc/fstab



```
$ cat/etc/fstab
# <file system>                          <mount point>      <type>  <options>          <dump>  <pass>
UUID=db1ab3ae-bb9a-4c4f-bcf9-87233c66ad50 /                ext4    errors=remount-ro    0       1
UUID=38e23022-5d1c-4498-9c10-ab002be09dbb /home            ext4    defaults             0       2
UUID=9b1c1c87-f4ba-43f4-8046-41f0180f28c0 /tmp             ext4    defaults             0       2
UUID=681d69ab-a8e3-4da4-8bea-5a4ac7b387b8 /usr             ext4    defaults             0       2
UUID=5e75dcd2-5aef-4075-81a2-c57bf6cd49cc /var             ext4    defaults             0       2
UUID=089ef626-77f5-4004-b120-eb71200f178d none             swap    sw                   0       0
/dev/sr0                                  /media/cdrom0    udf,iso9660 user,noauto  0       0
/dev/sdb1                                 /media/usb0      auto rw,user,noauto      0       0
```

/etc/fstab



Filesystem Types

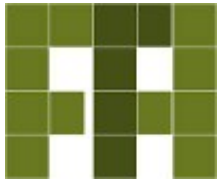
Type	System
Ext	GNU/Linux (versions of the kernel preceding version 2.1)
ext2	GNU/Linux (versions of the kernel after version 2.1)
ext3	GNU/Linux (versions of the kernel after versions 2.2 or 2.4)
ext4	GNU/Linux (versions of the kernel after versions 2.6)
swap	Swap system in GNU/Linux
sysv	UNIX type systems
minix	MINIX
iso9660	File system that most CDs use
nfs	Remote file system (Network File System)
smbfs	Remote file system in Windows ™ networks (Samba File System)
ntfs	Tree of WindowsNT™
msdos	MS-DOS™
vfat	Tree of Windows95™

Mount options

Meaning of the option	Allow	Don't allow
Running binaries	`exec`	`noexec`
Use of the bit of SetUserId	`suid`	`nosuid`
Read-only files	`ro`	`rw`
Synchronised system (use of disk cache)	`sync`	`async`
Interpretation of special blocks or characters	`dev`	`nodev`
Permission for any user to mount or unmount the device	`user`	`nouser`
Swap type system	`sw`	

If `defaults`, is entered then the `rw`, `dev`, `exec`, `auto`, `nouser` and `async` options are actually used.

mount



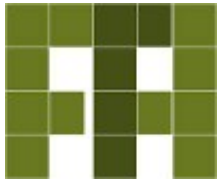
- Used to mount a file system.
- Options
  - -a - mount all file systems mentioned in fstab
  - -r - mount the file system read only
  - -w - mount the files system read write (this is the default)
  - -t - specifies the file system type
- Example:
  - Direct mount, no /etc/fstab

```
$ mount –t iso9660 /dev/cdrom /mnt/cd
```

  - Mount using entry within /etc/fstab

```
$ cat /etc/fstab | grep cdrom
/dev/cdrom      /media/cdrom    auto    ro,noauto,user,exec 0 0

$ mount /cdrom
$ mount |grep cdrom
/dev/hdc on /media/cdrom type iso9660
(ro,nosuid,nodev,user=dobriain)
```

umount



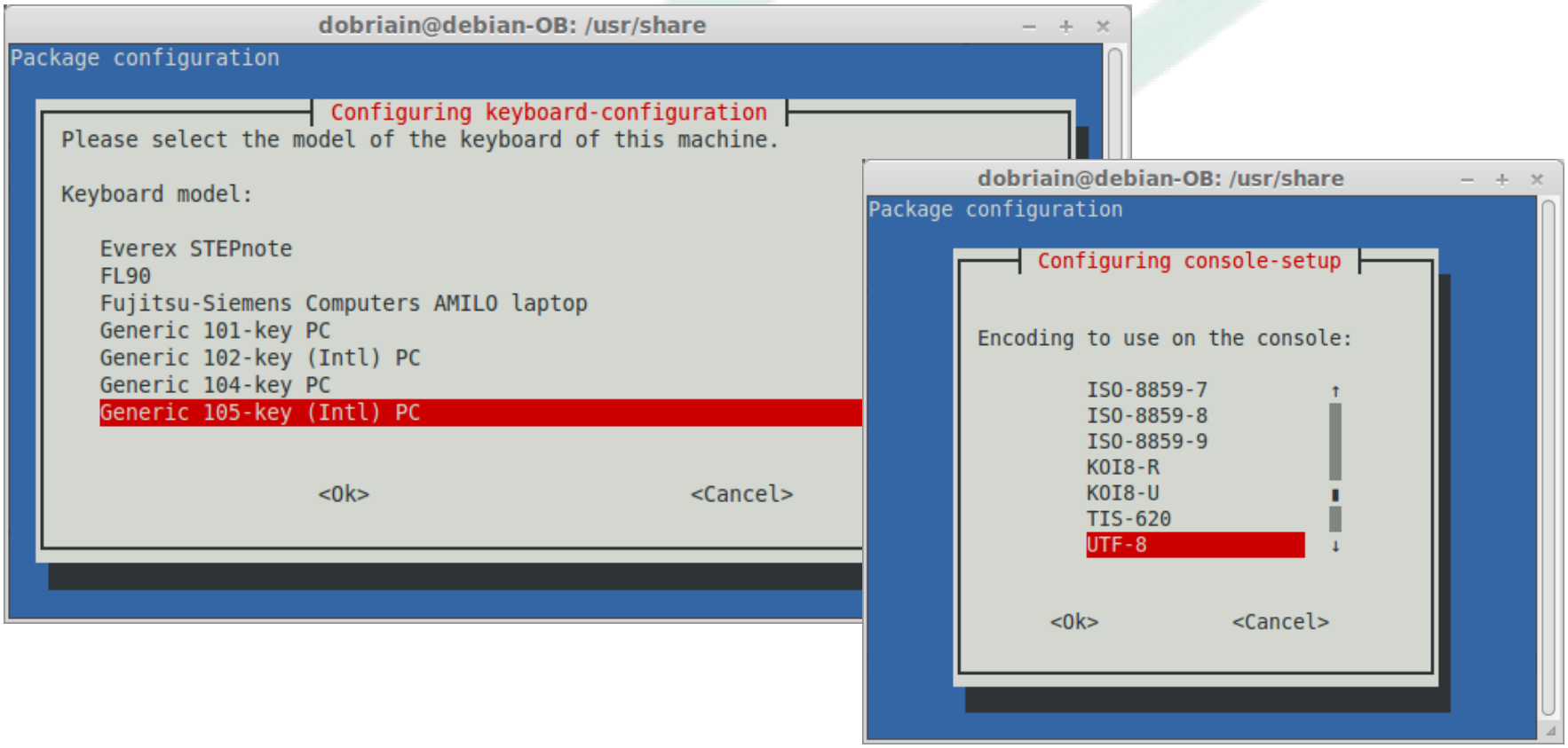
- Used to unmount a mounted file system.

```
$ mount |grep cdrom
/dev/hdc on /media/cdrom type iso9660 (ro,nosuid,nodev,user=dobriain)

$ umount /cdrom
$ mount |grep cdrom
$
```

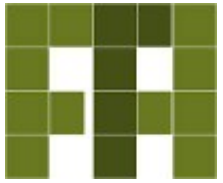
Device configuration - Keyboard

- Used to unmount a mounted file system.

```
$ sudo dpkg-reconfigure keyboard-configuration
$ sudo dpkg-reconfigure console-setup
```



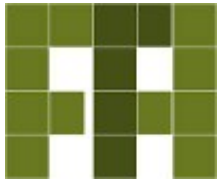
Device configuration – Terminal font



- `inputrc` deals with the mapping of the keyboard for certain situations.
- This file is the start-up file used by readline, the input related library used by bash and most other shells.

```
$ sudo cat /etc/inputrc
# /etc/inputrc - global inputrc for libreadline
# See readline(3readline) and `info rluserman' for more information.

# Be 8 bit clean.
set input-meta on
set output-meta on

# To allow the use of 8bit-characters like the german umlauts, uncomment
# the line below. However this makes the meta key not work as a meta key,
# which is annoying to those which don't need to type in 8-bit characters.

# set convert-meta off

# try to enable the application keypad when it is called.  Some systems
# need this to enable the arrow keys.
# set enable-keypad on
```

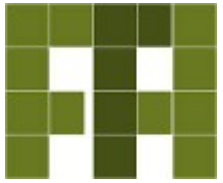
Device configuration – Console setup



- Console setup
  - /etc/console-setup/

```
$ cat /etc/console-setup/cat remap.inc
# The content of this file will be appended to the keyboard layout.
# The following is an example how to make Alt+j switch to to the next
# console and Alt+k switch to the previous console.

# Uncomment the following lines for Linux.  Notice that everything is
# replicated for all possible values of the modifiers shiftl, shiftr
# and ctrll (shiftl and shiftr are used for groups 1..4 of XKB and
# ctrll is used to fix the broken CapsLock when Linux console is in
# Unicode mode).

# alt keycode 36 = Incr_Console
# shiftl alt keycode 36 = Incr_Console

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```

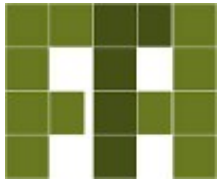
Device configuration – Locale setup



- Locale setup
  - /etc/locale.gen

```
$ cat /etc/locale.gen
# This file lists locales that you wish to have built. You can find a list
# of valid supported locales at /usr/share/i18n/SUPPORTED, and you can add
# user defined locales to /usr/local/share/i18n/SUPPORTED. If you change
# this file, you need to rerun locale-gen.


# aa_DJ ISO-8859-1
# aa_DJ.UTF-8 UTF-8
# aa_ER UTF-8
# aa_ER@saaho UTF-8
# aa_ET UTF-8
# af_ZA ISO-8859-1
# af_ZA.UTF-8 UTF-8
# am_ET UTF-8
# an_ES ISO-8859-15

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```

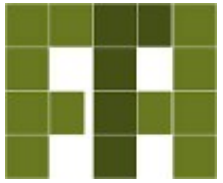
Device configuration – Locale setup



- Locale setup
  - /etc/locale.gen

```
$ cat /etc/locale.gen
# This file lists locales that you wish to have built. You can find a list
# of valid supported locales at /usr/share/i18n/SUPPORTED, and you can add
# user defined locales to /usr/local/share/i18n/SUPPORTED. If you change
# this file, you need to rerun locale-gen.


# aa_DJ ISO-8859-1
# aa_DJ.UTF-8 UTF-8
# aa_ER UTF-8
# aa_ER@saaho UTF-8
# aa_ET UTF-8
# af_ZA ISO-8859-1
# af_ZA.UTF-8 UTF-8
# am_ET UTF-8
# an_ES ISO-8859-15

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```

Device configuration – Locale



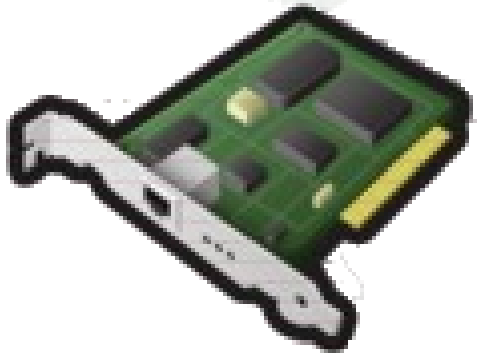
- Locale review

```
$ locale
LANG=en_IE.UTF-8
LANGUAGE=en_IE:en
LC_CTYPE="en_IE.UTF-8"
LC_NUMERIC="en_IE.UTF-8"
LC_TIME="en_IE.UTF-8"
LC_COLLATE="en_IE.UTF-8"
LC_MONETARY="en_IE.UTF-8"
LC_MESSAGES="en_IE.UTF-8"
LC_PAPER="en_IE.UTF-8"
LC_NAME="en_IE.UTF-8"
LC_ADDRESS="en_IE.UTF-8"
LC_TELEPHONE="en_IE.UTF-8"
LC_MEASUREMENT="en_IE.UTF-8"
LC_IDENTIFICATION="en_IE.UTF-8"
LC_ALL=
```

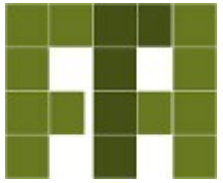
Device configuration – Network card

- discover - An extensible hardware detection and reporting interface.

```
$ sudo discover -t network
Intel Corporation PRO/Wireless 2915ABG [Calexico2] Network Connection
Broadcom Corporation NetXtreme BCM5751 Gigabit Ethernet PCI Express
```



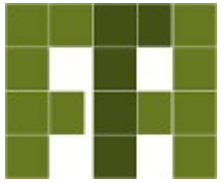
Device configuration – Network card



- If an interface is NOT mentioned in the `/etc/network/interfaces` file then if enabled the Network Manager will attempt to auto configure.
- For manual configuration add the configuration in the file. Here is a static configuration for a server.
- DNS is configured in the `/etc/resolv.conf`

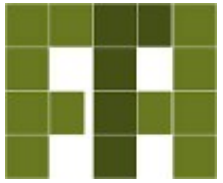
```
$ sudo cat /etc/network/interfaces
# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).

# The loopback network interface
auto lo
iface lo inet loopback

auto eth0
iface eth0 inet static
     address 106.23.2.7
     netmask 255.255.255.0
     Gateway 106.23.2.254
:wq!

$ cat /etc/resolv.conf
nameserver 187.96.97.1
nameserver 187.96.97.2
```

Device configuration – WiFi



```
$ iwlist eth1 scan
eth1      Scan completed :
          Cell 01 - Address: D4:CA:6D:70:90:D7
                    Channel:8
                    Frequency:2.447 GHz (Channel 8)
                    Quality=70/70  Signal level=-33 dBm
                    Encryption key:on
                    ESSID:"C2S-FTA"
                    Bit Rates:1 Mb/s; 2 Mb/s; 5.5 Mb/s; 11 Mb/s; 6 Mb/s
                              9 Mb/s; 12 Mb/s; 18 Mb/s
                    Bit Rates:24 Mb/s; 36 Mb/s; 48 Mb/s; 54 Mb/s
                    Mode:Master
                    Extra:tsf=0000000000000000
                    Extra: Last beacon: 17004ms ago
                    IE: Unknown: 0009524950504C45434F4D
                    IE: Unknown: 010882848B960C121824
                    IE: Unknown: 030108
                    IE: Unknown: 2A0100
                    IE: Unknown: 2D1A2C1003FFFF0000000000000000000000000000000000000000
                    IE: IEEE 802.11i/WPA2 Version 1
                        Group Cipher : CCMP
                        Pairwise Ciphers (2) : CCMP TKIP
                        Authentication Suites (1) : PSK
                    IE: Unknown: 32043048606C
                    IE: Unknown: 3D160800000000000000000000000000000000000000000000
                    IE: Unknown:
DD2A000C42000000011E00100000066070600004434434136443730393044370000000000000000005028F09
                    IE: Unknown: DD180050F2020101000003A4000027A4000042435E0062322F00
                    IE: Unknown:
DD1E00904C332C1003FFFF0000000000000000000000000000000000000000
                    IE: Unknown: DD1A00904C340800000000000000000000000000000000000000000000
```

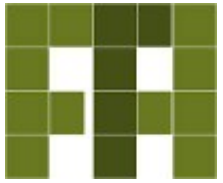
Device configuration – WiFi



- Scan for available networks and get network details.
- Edit /etc/network/interfaces. The required configuration is dependent on each particular setup.

```
$ sudo cat /etc/network/interfaces
# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).

# The loopback network interface
auto lo
iface lo inet loopback

# my wifi device
auto wlan0
iface wlan0 inet dhcp
        wireless-essid C2S-FTA
        wireless-mode Master
:wq!
```

Device configuration – Modems / PPP



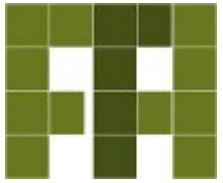
- Point to Point Protocol (PPP) is used to establish a network over modem connections.
- The pppconfig application is normally used to configure a modem; the application writes the configuration files that are necessary for the PPP system's daemon.
- Series of steps to be taken:
  - Name of the provider.
  - Configuration of name servers with the file `/etc/resolv.conf`.
  - Authentication, Peer Authentication Protocol (PAP) or Challenge Authentication Protocol (CHAP).
  - User name and password.
  - Modem speed: i.e. 115200 bps.
  - Pulse or tone dialling.
  - Telephone number.
  - Communication port, i.e. `/dev/ttySX`, where the `X` is a 0 for COM1, a 1 for COM2 etc.
- To establish the connection with the our provider, start up the daemon as follows:

```
$ /etc/init.d/ppp start

$ /etc/init.d/ppp stop
```

What is PPPoE

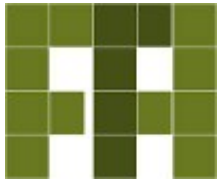
- The Point-to-Point Protocol over Ethernet (PPPoE) is a network protocol for encapsulating Point-to-Point Protocol (PPP) frames inside Ethernet frames.
- It is used mainly with DSL services where individual users connect to the DSL modem over Ethernet and in plain Metro Ethernet networks.
- Ethernet networks are packet-based and have no concept of a connection or circuit and also lack basic security features to protect against IP and MAC conflicts and rogue DHCP servers.
- PPPoE mimics the "dial“ a circuit concept over an Ethernet network, establishing a point to point connection between them and then securely transport data packets over the connection.

Device configuration – ADSL and PPPoE



- Asymmetric digital subscriber line (ADSL) is a communication technology for data over telephone and television cables.
- Asymmetric communication implies that the download and upload time rates are different; generally, the upload rate is slower.
- PPP over Ethernet (PPPoE) is used to establish a network over Asynchronous Digital Subscriber Line (ADSL), it is similiar to PPP but is established over a multipoint network instead of over a Point to Point channel like a telephone line.
- PPPoE is used to mimic to Point to Point nature of a telephone network on a broadcast network like that provided by ADSL or Ethernet and therefore control of the subscribers is maintained. Authentication is typically by Remote Access Dial In User Service (RADIUS) as is also used in a dialup PPP enviornment.

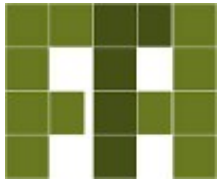
Device configuration – Sound



- Advanced Linux Sound Architecture (ALSA) provides audio and MIDI functionality to the Linux operating system.
- Check the Operating System can see the sound hardware.
- Add the user to the audio group in /etc/group.

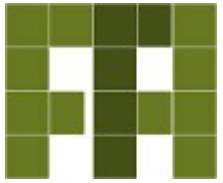
```
$ sudo discover -t audio
Intel Corporation 82801FB/FBM/FR/FW/FRW (ICH6 Family) AC'97 Audio Controller
$ lspci | grep audio
00:1e.2 Multimedia audio controller: Intel Corporation 82801FB/FBM/FR/FW/FRW
(ICH6 Family) AC'97 Audio Controller (rev 03)

$ sudo addgroup audio dobriain

$ cat /etc/group |grep audio
audio:x:29:pulse,dobriain

$ sudo alsa
Usage: /usr/sbin/alsa
{unload|reload|force-unload|force-reload|suspend|resume}
```

Device configuration – Printing



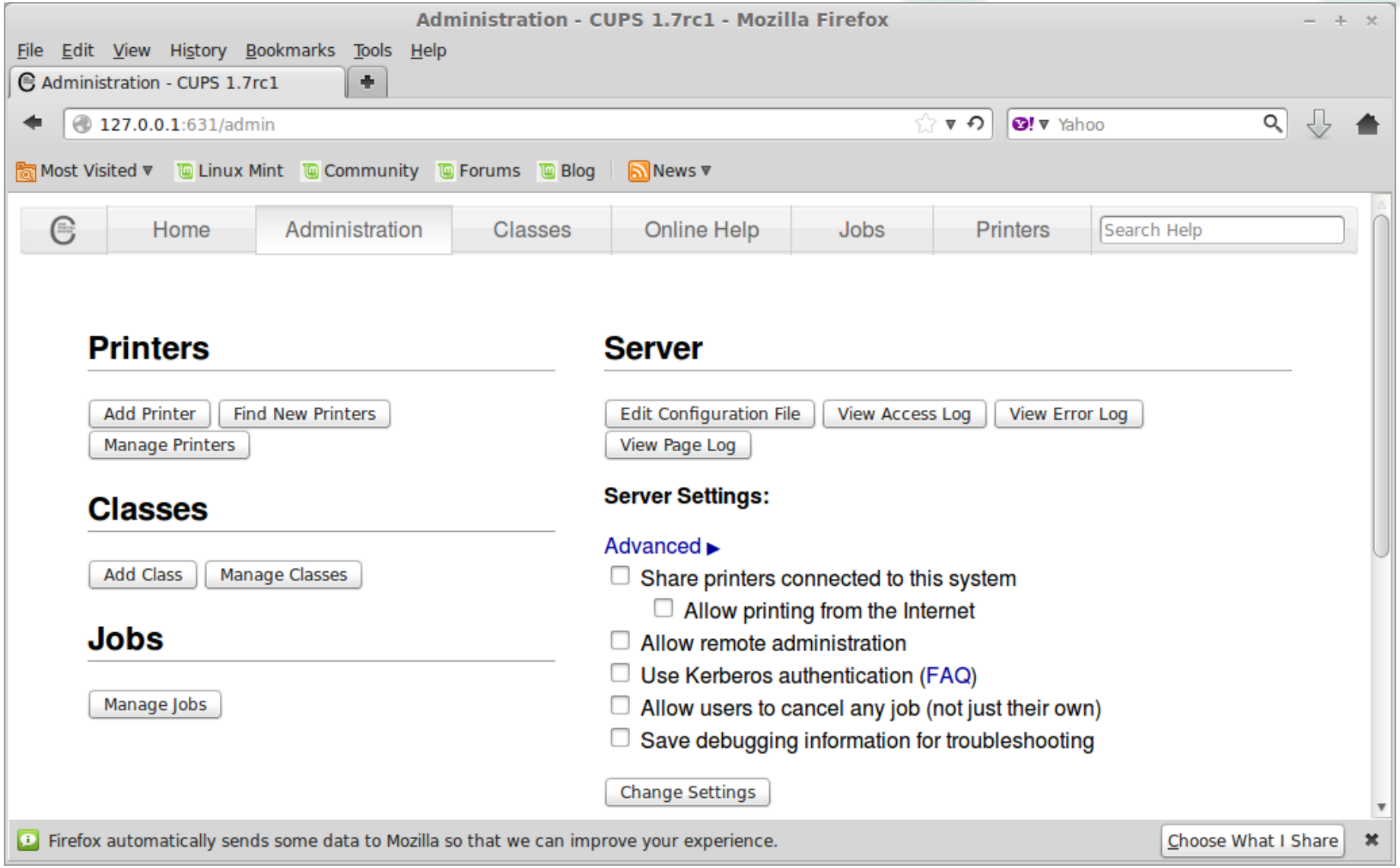
- **lpd** - one of the first printing daemons for UNIX type systems. It has to be configured manually.
- **lpr** - the BSD version of lpd.
- **lprng** - applications based on lpr with the advantage of incorporating a configuration tool called lprngtool, which makes it possible to configure the printer graphically and easily.
- **gnulpr** - the GNU version of the printing system lpr. It also incorporates graphical configuration tools, service management tools etc.
- **Common UNIX Printing Systems (CUPS)** - this set of applications is compatible with the lpr commands and can also be used in Windows networks. It uses a set of its own filters and supports most of the printers on the market.
- **SAMBA** – Samba is the standard Windows interoperability suite of programs for Linux. With SAMBA a Linux Server can be setup as a print server for a Microsoft Windows domain.

Device configuration – Printing - CUPS



- Open your web browser and got to http://localhost:631/
- Press on **Administration** tap and click on **Add Printer**. If you're asked for user and password, type name of user and password of your operating system.
- Select **Internet Printing Protocol (http)** in "**Other Networks Printers**"
- On connection tab fill in: socket://hostname
  - For example, the hostname, could be the IP of your printer.
  - Something like that: socket://10.34.21.25
- At this point you will be asked for Name, Description and Location of your printer. Fill in as you like and press **continue**.
- Select PPD File and browse to the folder on your computer where the PPD File is. (Ricoh-Aficio_MP_C2551-pxlcolor-Ricoh.ppd)
- Once you selected it, press **Add Printer**.
- Now is possible to set default options or Query Printer for Default Options.
- From now the printer is ready for use. At **http://localhost:631** is possible to see Printers installed on your system, configure them and manage jobs..

Device configuration – Printing - CUPS



Daemons and runlevels

C²S CONSULTING

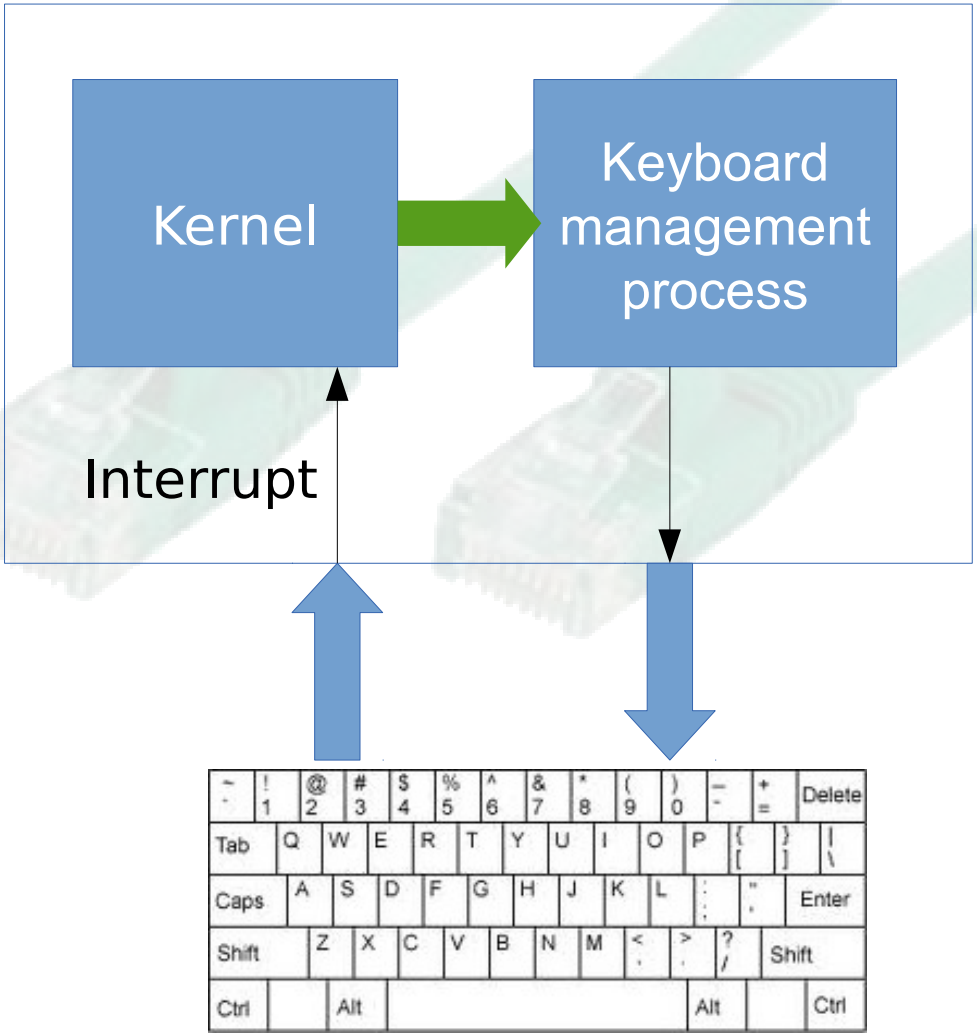
Diarmuid Ó Briain
CEng, FIEI, FIET, CISSP

diarmuid@obriain.com

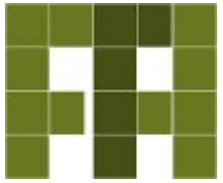
FREE TECHNOLOGY ACADEMY

Powered by debian GNU/Linux

Interruptions

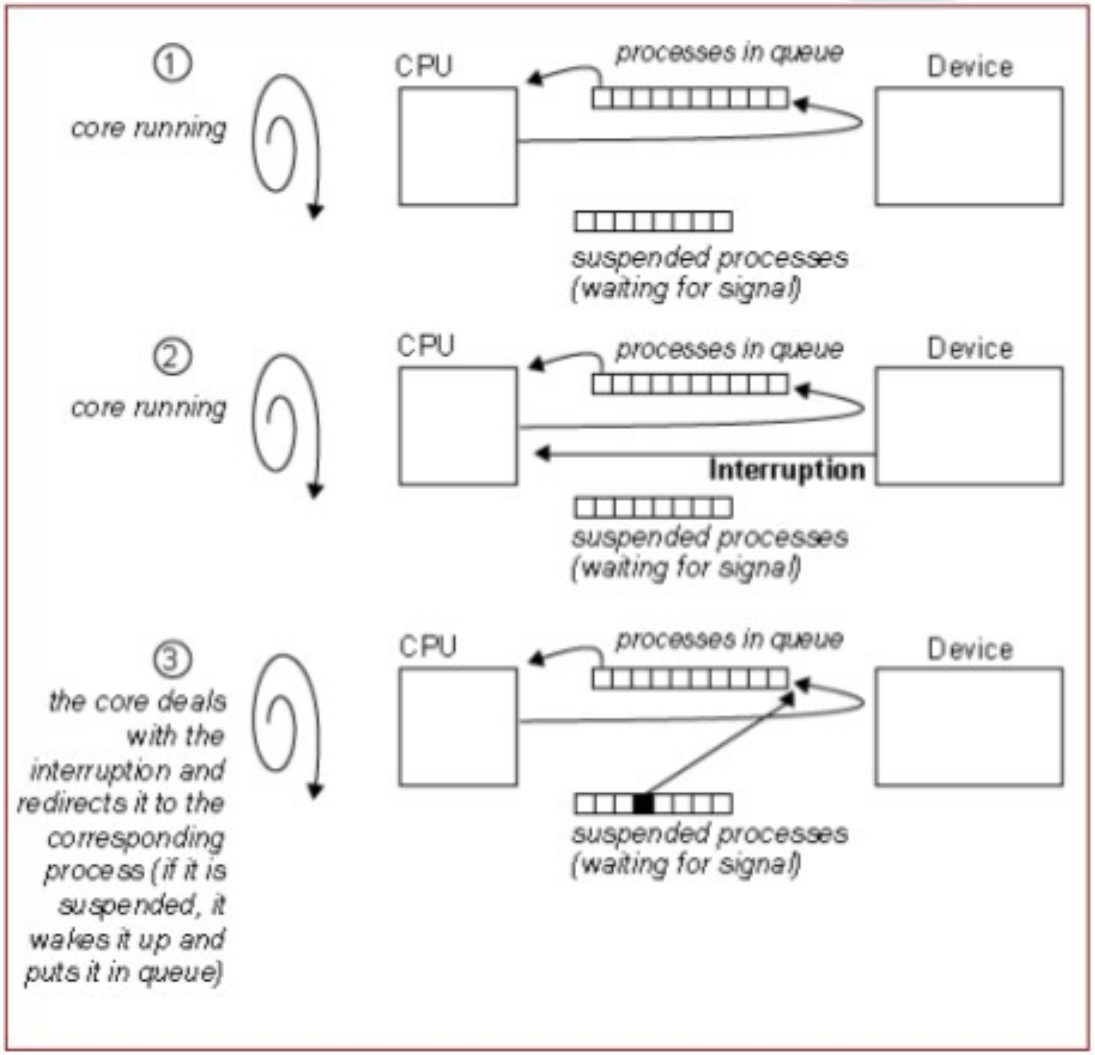


daemon

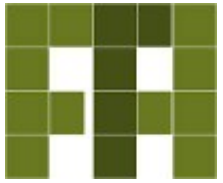


- Disk And Execution MONitor (daemon).
- Loaded in the memory, waiting for some signal (interruptor the kernel itself).
- Signal causes it to wake up and execute the functions required.
- Daemons that we have loaded do not take up CPU whilst they are not strictly necessary.
- Daemon parents is generally the `init` process.
- Daemon names end with the letter `d`: i.e.,
  - `syslogd` is the daemon that implements the system logging facility.
  - `sshd` is a daemon that services incoming SSH connections.

Daemons and interruptions

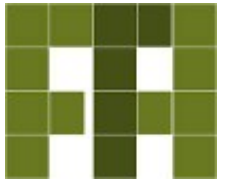


System management daemons

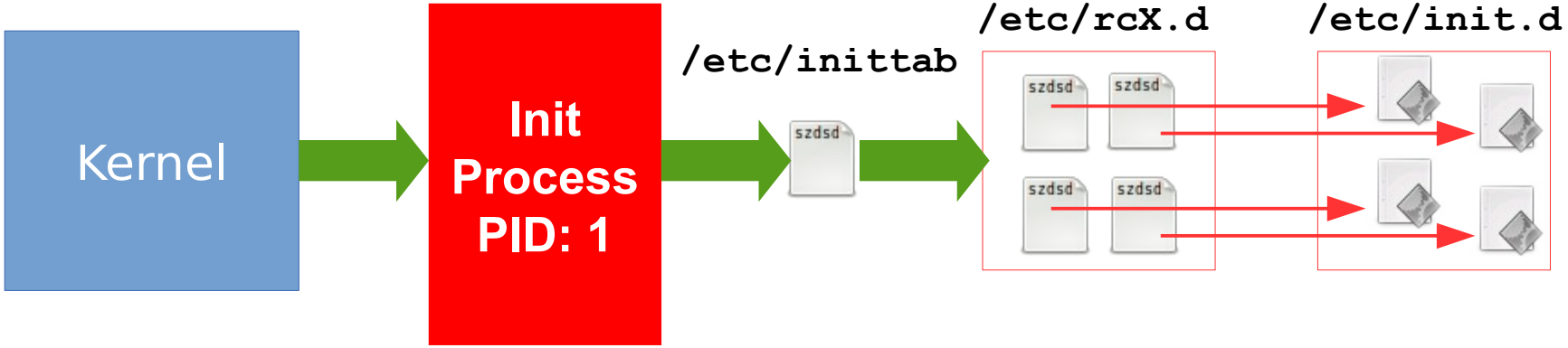


- System V (SysV)
  - Examines a `/etc/inittab` file for an `:initdefault:` entry, which defines any default runlevel.
  - If there is no default runlevel, then `init` dumps the user to a system console for manual entry of a runlevel.
  - Current detault in Debian.
- Upstart
  - Event-based replacement for the traditional `init` daemon
  - It uses configuration files in /etc/init to determine the stating daemons.
  - It was written by Scott James Remnant of Canonical Ltd.
  - Used on Ubuntu, Mint, RedHat enterprise and Oracle Linux.
  - In consideration by Debian.
- Systemd
  - Another potential replacement for SysV.
  - Starts up and supervises the entire system and is based around the notion of units composed of a name and a type and matching configuration files.
  - Uses a utility called `systemctl` to manage daemons.
  - Used in Fedora and Arch Linux.

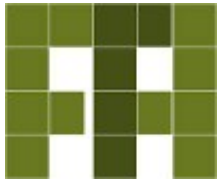
SysV init



- The `init` process is called by the kernel during boot and the process is given Process ID: 1.
- Init looks to the `/etc/inittab` file for the default runlevel and executes the “S” scripts in `/etc/rcX.d` where X represents the runlevel.
- The “S” scripts are shortcuts to actual process scripts in `/etc/init.d` where they are started with the case start.



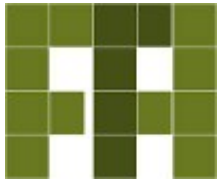
Runlevels



- 0 Halt the system.
- 1 Single-user / minimal mode.
- 2 - 5 Multiuser modes.
- 6 Reboot the system.

halt, shutdown, poweroff	init 0
reboot	init 6

/etc/inittab

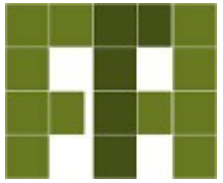


- The `/etc/inittab` file describes which processes are started at bootup and during normal operation. (e.g. /etc/init.d/boot, /etc/init.d/rc, gettys...).
- `init` distinguishes multiple runlevels, each of which can have its own set of processes that are started.
- An entry in the inittab file has the following format:
  - <id>:<runlevels>:<action>:<process>

Extract from /etc/inittab

```
# The default runlevel.
id:2:initdefault:

l2:2:wait:/etc/init.d/rc 2.
```

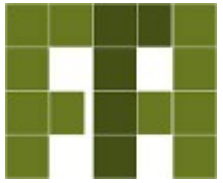
/etc/init.d



- The `/etc/init.d/` directory contains `init` scripts to manage daemons.
- These that make it possible to `start`, `stop` or see a daemons `status`.

```
$ ls /etc/init.d
acpid               dns-clean           procps              single
anacron             friendly-recovery   pulseaudio          skeleton
atd                 grub-common         rc                  smbd
avahi-daemon        halt                rc.local            speech-dispatcher
binfmt-support      hddtemp             rcS                 sudo
bluetooth           irqbalance          README              udev
brltty              kerneloops          reboot              umountfs
casper              killprocs           resolvconf          umountnfs.sh
console-font        kmod                rfkill-restore      umountroot
console-setup       lm-sensors          rfkill-store        unattended-upgrades
cron                mdm                 rsync               urandom
cryptdisks          mintsystem          rsyslog             virtualbox
cryptdisks-early    networking          samba               virtualbox-guest-utils
cups                nmbd                saned               virtualbox-guest-x11
cups-browsed        ondemand            sendsigs            winbind
dbus                pppd-dns            setvtrgb            x11-common
```

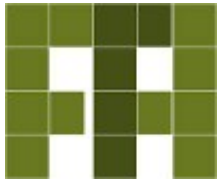
/etc/init.d



- daemons have a shell script located in the `/etc/init.d/` directory.
- These that make it possible to `start`, `stop` or see a daemons `status`.
- It is also possible to use the `service` command to manage the `init` scripts.

```
/etc/init.d $ ./cups status
Status of Common Unix Printing System: cupsd is running.

$ service cups status
cups start/running, process 6064
```

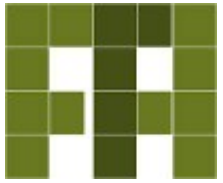
/etc/init.d



- Start
  - To start the daemon. If it is already running, an error message will appear.
- Stop
  - To stop the daemon. If it is not already running, an error message will appear.
- Restart
  - Restarts the daemon. This can be used to reread its configuration files.
- Reload
  - Although not all the daemons allow this, this parameter can be used to reload the configuration files, without having to stop it.

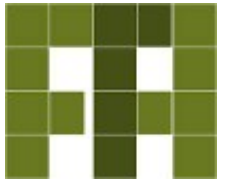
```
/etc/init.d $ ./cups
Usage: /etc/init.d/cups {start|stop|restart|force-reload|status}
```

Runlevels



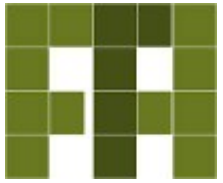
- Each runlevel has a directory located in `/etc/rcX.d/` where `X` is the number of the level.
- In these directories, we will find symbolic links to the daemon shell scripts in `/etc/init.d`.
- Links begin with either
- `S` (start) we tell the system that we want to start the daemon.
- `K` (kill) we tell the system that we want to stop or kill it.
- After this letter, a number with 2 figures, between `00` and `99`.
- This indicates the order in which they must start or stop.

Runlevels



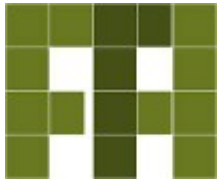
Runlevel 2		Daemons running
K50sshd K51apache-ssl K52tftpd K53telnet	S10sysklogd S12kerneld S20dhcpd S50proftpd S90apache	sysklogd kerneld dhcpd proftpd apache
Runlevel 3		
K50dhcpd K51proftpd K52apache K53tftpd K53telnet	S10sysklogd S12kerneld S20sshd S50apache-ssl	sysklog kerneld sshd apache-ssl
Runlevel 4		
K50dhcpd K51proftpd K52apache K53tftpd K53telnet	S10syslogd S12kerneld S20tftpd S50telnet	sysklogd kerneld tftpd telnet

/etc/rcX.d



```
/etc/rc0.d$ ls
K01atd                    K02sendsigs       K05rpcbind      K08umountroot
K01exim4                  K03rsyslog        K06hwclock.sh   K09halt
K01urandom                K04umountnfs.sh   K06networking   README
K01xe-linux-distribution  K05nfs-common     K07umountfs

/etc/rc1.d$ ls
K01atd                    K03rsyslog      README          S01motd
K01exim4                  K05nfs-common   S01bootlogs     S02single
K01xe-linux-distribution  K05rpcbind      S01killprocs

/etc/rc2.d$ ls
README       S01xe-linux-distribution  S16rsyslog  S17cron   S18rc.local
S01bootlogs  S13rpcbind                S16sudo     S17exim4  S18rmnologin
S01motd      S14nfs-common             S17atd      S17ssh

/etc/rc6.d$ ls
K01atd                    K02sendsigs       K05rpcbind      K08umountroot
K01exim4                  K03rsyslog        K06hwclock.sh   K09reboot
K01urandom                K04umountnfs.sh   K06networking   README
K01xe-linux-distribution  K05nfs-common     K07umountfs

$ runlevel
N 2
```

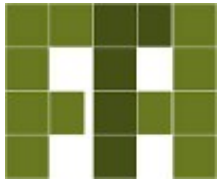
shutdown



- shutdown
  - Brings system down in a secure organised fashion.
  - Format : Shutdown [options] time [message].
- options
  - -f - Fast boot
  - -F - Force filesystem checks on next reboot
  - -h - Halt after shutdown
  - -k - Don't really shutdown but send the warning message
  - -r - Reboot after shutdown

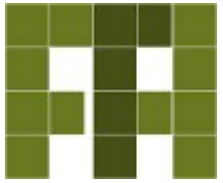
```
$ sudo shutdown -k now "This system is shutting down"
[sudo] password for dobriain: <password>

Broadcast message from dobriain@riomhaire
        (/dev/pts/0) at 2:19 ...

The system is going down for maintenance NOW!
This system is shutting down
```

System log (rsyslog)



- **`rsyslogd`**
  - Replaced sysklogd in Debian since Debian v5.0 (Lenny).
  - `rsyslogd` daemon is responsible for collecting service messages coming from applications and the kernel, then distributing them into log files, typically in `/var/log`.
  - It obeys the `/etc/rsyslog.conf` configuration file.
- **`rsyslog.conf`**
  - `rsyslog.conf` file is the main configuration file for the rsyslogd which logs system messages.
  - This file specifies rules for logging.
  - Each log message is associated with an application subsystem (called “facility”and each message is also associated with a priority level.

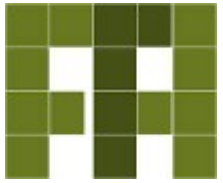
System log (rsyslog)



- **/etc/default/rsyslog**

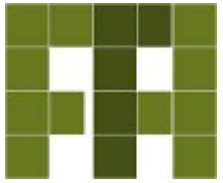
```
$ cat rsyslog
# Options for rsyslogd
# -x disables DNS lookups for remote messages
# -c compatibility mode
# See rsyslogd(8) for more details
RSYSLOGD_OPTIONS="-c5"
```

Rsyslog “Facilitiess”



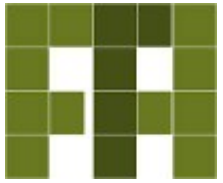
- **auth and authpriv**: for authentication;
- **cron**: comes from task scheduling services, cron and atd;
- **daemon**: affects a daemon without any special classification (DNS, NTP, etc.);
- **ftp**: concerns the FTP server;
- **kern**: message coming from the kernel;
- **lpr**: comes from the printing subsystem;
- **mail**: comes from the e-mail subsystem;
- **news**: Usenet subsystem message (especially from an NNTP — Network News Transfer Protocol — server that manages newsgroups);
- **syslog**: messages from the syslogd server, itself;
- **user**: user messages (generic);
- **uucp**: messages from the UUCP server (Unix to Unix Copy Program);
- **local0 to local7**: reserved for local use.

Rsyslog “Priorities”



- **emerg**: “Help!” There's an emergency, the system is probably unusable.
- **alert**: hurry up, any delay can be dangerous, action must be taken immediately;
- **crit**: conditions are critical;
- **err**: error;
- **warn**: warning (potential error);
- **notice**: conditions are normal, but the message is important;
- **info**: informative message;
- **debug**: debugging message.

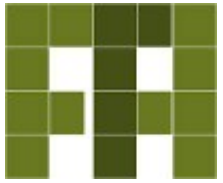
/etc/syslog.conf



- Extract from rsyslog.conf

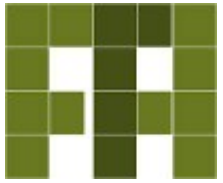
```
auth,authpriv.*                 /var/log/auth.log
*.*;auth,authpriv.none          -/var/log/syslog
#cron.*                         /var/log/cron.log
daemon.*                        -/var/log/daemon.log
kern.*                          -/var/log/kern.log
lpr.*                           -/var/log/lpr.log
mail.*                          -/var/log/mail.log
user.*                          -/var/log/user.log
```

Log file rotation



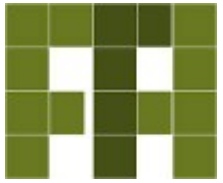
- logrotate
  - logrotate - rotates, compresses, and mails system logs.
  - logrotate is designed to ease administration of systems that generate large numbers of log files.
  - It allows automatic rotation, compression, removal, and mailing of log files.
  - Each log file may be handled daily, weekly, monthly, or when it grows too large.
- /etc/logrotate.conf
  - `logrotate.conf` is the logrotate configuration file.
  - Defines the actions that logrotate will take when in operation, compression of files, mail etc..

Log file rotation



- logrotate
  - logrotate - rotates, compresses, and mails system logs.
  - logrotate is designed to ease administration of systems that generate large numbers of log files.
  - It allows automatic rotation, compression, removal, and mailing of log files.
  - Each log file may be handled daily, weekly, monthly, or when it grows too large.
- /etc/logrotate.conf
  - `logrotate.conf` is the logrotate configuration file.
  - Defines the actions that logrotate will take when in operation, compression of files, mail etc..

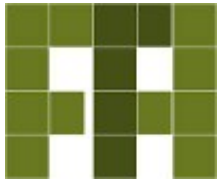
Cron



- Daemon to execute scheduled commands.
- It is started automatically from /etc/init.d on entering multi-user runlevels.
- Enable cron
  - Add an empty cron.deny file or only root can run cron otherwise add specific users in a cron.allow file.

```
$ touch /etc/cron.d/cron.deny
```

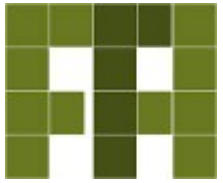
Cron



- Rerun the cron daemon.

```
$ sudo service cron restart
[sudo] password for dob:
[....] Restarting periodic command scheduler: cron
[....] Stopping periodic comma
[ ok heduler: cron.
[ ok ] Starting periodic command scheduler: cron.
```

Crontab



- Add entries to the users crontab file. The format is as follows

```
SHELL=/bin/sh
Min Hour Day Month Day of week
What to run (always absolute path to file)

Min              1-59
Hour             0-23
Day              1-31
Month            1-12
Day of Week      0-Sun, 1-Mon, etc.. 6-Sat
```

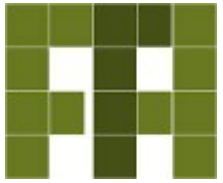
run fetch mail on the 30th minute of every hour.

```
30 * * * *      /usr/bin/fetchmail
```

run fetchmail every 2 minutes.

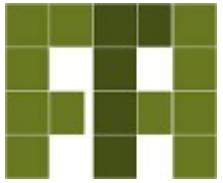
```
1-59/2 * * * *          /usr/bin/fetchmail
```

Cron



```
$ cat cron_test.pl

#!/usr/bin/perl -w
$Date=`date`;
open (MAIL, "|/usr/sbin/sendmail -t");
print MAIL "To: root\nFrom: cron_test\n";
print MAIL "Subject: This mail was sent on $date \n";
print MAIL "A Test Mail\n\nDiarmuid\n";
close (MAIL);

:wq!
~
~
$ chmod 700 cron_test.pl
```

Cron

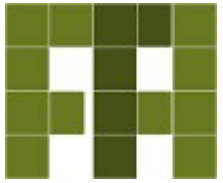


```
$ crontab -e

SHELL=/bin/bash

1-59/2 * * * *      /usr/bin/fetchmail
1-59/2 * * * *      /home/dobriain/Desktop/cron_test.pl
:wq!
~
~

crontab: installing new crontab
```

The crontab file for a user is stored in

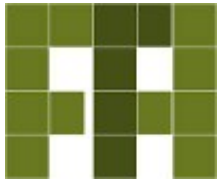
```
/var/spool/cron/tabs/name_of_user
```

Cron



```
$ crontab -l
# DO NOT EDIT THIS FILE - edit the master and reinstall.
SHELL=/bin/bash

* */30 * * *    /usr/bin/fetchmail

$ date
Sat Jan  4 23:59:32 GMT 2014
```

Cron



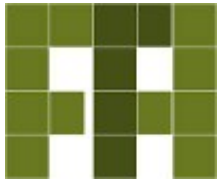
- Check your root mail to see if the crontab is actually working.

```
$ sudo mail -f /var/mail/root
Mail version 8.1 6/6/93.  Type ? for help.
"/var/mail/root": 1 message 1 unread
>   1 cron_test@gluais.dia  Thu Jun 14 02:37  14/449
& n
Message 1:
From dobriain@gluais.diarmuid.ob  Sat Jan 4 23:59:32 GMT 2014
Date: Sat, 4 Jan 2014 02:37:00 +0100
To: root@gluais.diarmuid.ob
From: cron_test@gluais.diarmuid.ob
Subject: This mail was sent on Sat Jan  4 23:59:32 GMT 2014

A Test Mail
```

- Remove a crontab.

```
$ crontab -r
```

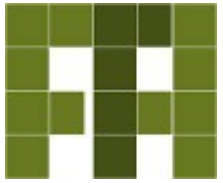
at and batch



- Similar to cron but used for once off executions
  - Format : `at [-f file] <time>` / `at [options]`
  - `at` - executes commands at a specified time.
  - `batch` - executes commands when system load levels permit, when the load average drops below 1.5.

- The files corresponding to the delayed tasks are stored in:
  - `/var/spool/cron/atjobs/`
  - `/var/spool/cron/atspool/`

at and batch



```
$ sudo at 18:30 tomorrow
warning: commands will be executed using /bin/sh
at> /home/dobriain/myprog
at> ^D
job 1 at 2014-01-03 18:30
```

List 'at' jobs.

```
$ sudo at -l
1       2014-01-03 18:30 a root
```

Delete job number.

```
$ sudo at -d 1        or     $ sudo atrm 1
```

Thank you