

# Raspberry Pi & Co



**Practice and theory**

Raspberry Pi software

# RPi Software



## Raspberry Pi booting (SD-card)

### First stage:

Mount the FAT32 boot partition on the SD card.  
Programmed in SOC  
(second stage bootloader can be accessed)

### Second stage:

Dedicated risc-core executes bootcode.bin  
Load GPU firmware from the SD card  
Program and starts the GPU with start.elf

### Third stage:

GPU is started and uses fixup.dat to configure  
the SDRAM-partition between GPU and CPU  
Once done CPU takes over

### Fourth stage:

OS is loaded by CPU, default load kernel.img (Linux)  
But you can be override the default in config.txt

#### Naam

	bootcode.bin
	cmdline.txt
	config.txt
	fixup.dat
	fixup_cd.dat
	fixup_x.dat
	issue.txt
	kernel.img
	kernel_emergency.img
	start.elf
	start_cd.elf
	start_x.elf

# RPi Software



## Raspberry Pi Operating Systems

### **Raspbian**

A community-created port of Debian wheezy, optimised for the Raspberry Pi

### **Fedora**

Pidora is a Fedora Remix optimized for the Raspberry Pi

### **RaspBMC and OpenELEC**

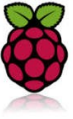
XBMC Mediacenter distributions

### **RISC OS**

OS dating from 1987, originally used for BBC Micro

**... and many more ....**

# RPi Software

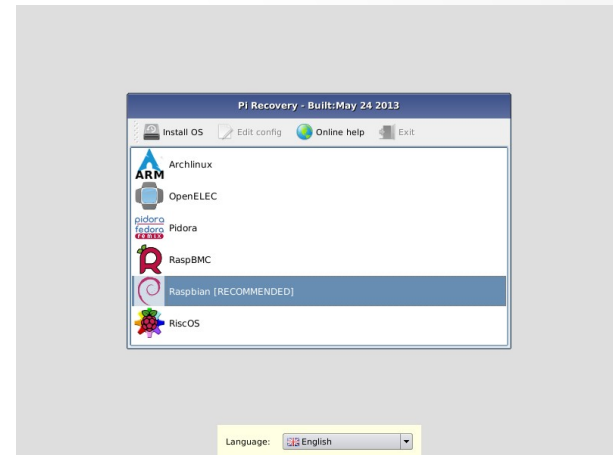


## NOOBS (New Out Of Box Software)

Advanced installation tool,  
recommended to starters

Switch easily to different OS

Overwrite corrupted card



2 versions:

Offline version containing  
Raspbian – Pidora – OpenElec and RaspBMC

Online version (lite) for limited SD-cards

# RPi Software



## Prepared SD-cards

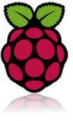
In case you

- don't have access to another PC
- are in a hurry
- fear the command line
- just to lazy to do it your self
- ...

you can buy a pre-installed  
and installed SD-card



# RPi Software



## Getting started (example Raspbian)


### First step => go to:

<http://raspberrypi.org/downloads/>

Scroll down to Raspbian and download

Why start with Raspbian?

- NOOBS too easy for an example
- Default OS for RPi and most support
- Built on one of the most stable OS ever Debian (Raspberry and Debian)

 Raspberry Pi®

Quick Start Downloads

Documentation [Link](#)

### Raw Images

The following raw images are intended for advanced users. To use an image file, you will need to unzip it and write it to a suitable (2GB or larger, 4GB or larger for Raspbian) SD card using the UNIX tool [dd](#). Windows users should use [Win32DiskImager](#). Do not try to drag and drop or otherwise copy over the image without using [dd](#) or [Win32DiskImager](#) – it won't work. If you're still not clear on what to do, the community on the Raspberry Pi Wiki has written a [guide for beginners](#) on how to set up your SD card.

### Raspbian




Image	<a href="#">2014-01-07-wheezy-raspbian.zip</a>
Torrent	<a href="#">2014-01-07-wheezy-raspbian.zip.torrent</a>
SHA-1 Checksum	9d0afb932ec22e3c29d733693f58b0406bcab86
Default login	pi / raspberry
Description	A community-created port of Debian wheezy, optimised for the Raspberry Pi
Release Date	2014-01-07
Version	wheezy
Kernel	3.10
URL	<a href="#">Link</a>
Release Notes	<a href="#">release_notes.txt</a>

# RPi Software



## Getting started (example Raspbian)

### Second step => Software at you PC

Not just copying the content of the zip on the SD-card

Make sure you download tools for burning image (byte representation of the actual content) on sd-card

**dd** for Linux, Mac and FreeBSD (command line tool)

**Image Writer** for Windows

<https://launchpad.net/win32-image-writer>

# RPi Software



## Getting started (example Raspbian)

### Third step => Burn the image

Unzip the image

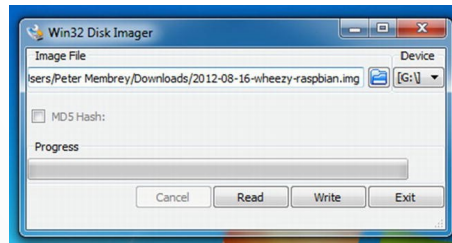
Depending on your OS

**dd** for Linux, Mac and FreeBSD

```
sudo dd if=path_of_your_image.img of=/dev/diskn bs=1m
```

**Image Writer** for Windows

start image writer and follow instructions





# RPi Software



## Getting started (example Raspbian)

### Fourth step => Start up

Plug in the SD in the SD-slot of the Rpi

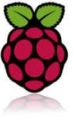
Make sure to have the RPi connected

- HDMI or DVI-screen
- Mouse and keyboard
- Network-cable

Connect the RPi to a USB-power



# RPi Software



## Getting started (example Raspbian)

### Fifth step => First boot

Raspbian starts up

And a command line appears

Don't panic you won't need it too much

Just for support:

ls => for listing files

sudo \${othercommand} => running command as admin

cd \${directory} => for navigating

cd .. => go up

pwd => current location

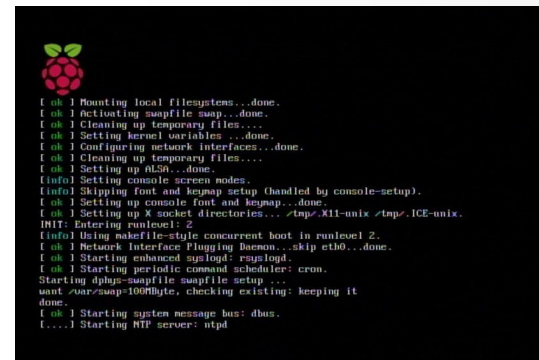
mkdir => creating directory

cat \${filename} => view content of file

touch \${filename} => create empty file

nano \${filename} => editing file

vi \${filename} => advanced editing file

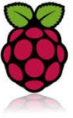


```
[ ok ] Mounting local filesystems...done.
[ ok ] Activating swapfile swap...done.
[ ok ] Cleaning up temporary files...
[ ok ] Setting kernel variables...done.
[ ok ] Configuring network interfaces...done.
[ ok ] Cleaning up temporary files...done.
[ ok ] Setting up ALSA...done.
[info] Setting console screen modes.
[info] Skipping font and keypad setup (handled by console-setup).
[ ok ] Setting up console font and keypad...done.
[ ok ] Setting up X socket directories... /tmp/.X11-unix /tmp/.ICE-unix.
[info] Entering runlevel: 2
[info] Using nfs-kernel-server concurrent boot in runlevel 2.
[ ok ] Network Interface Plugging Daemon...skip eth0...done.
[ ok ] Starting enhanced syslogd: rsyslogd.
[ ok ] Starting periodic command scheduler: cron.
Starting dphys-swapfile swapfile setup ...
want /var/swap=100MByte, checking existing: keeping it
done.
[ ok ] Starting system message bus: dbus.
[....] Starting NTP server: ntpd
```



```
bart@bvpers2:~$
```

# RPi Software

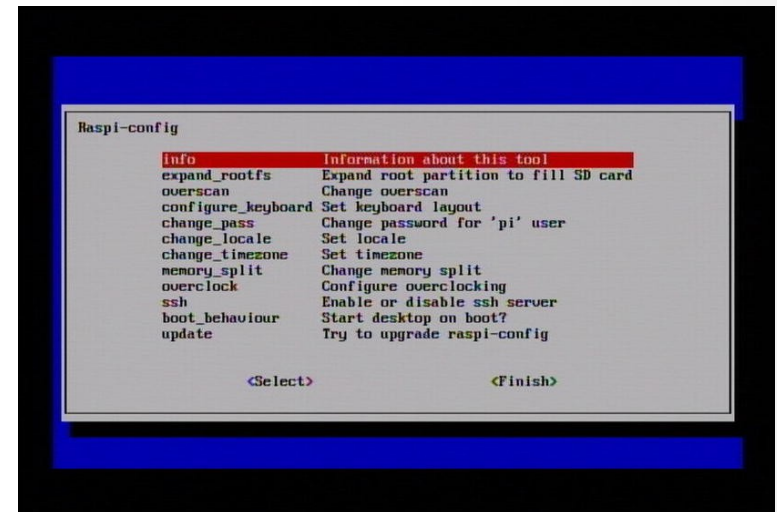


## Getting started (example Raspbian)

### Sixth step => Time to configure your RPi

\$ sudo raspi-config

- Configure to boot directly in desktop-mode (boot\_behavior)
- Change your password (change\_pass)  
STRONGLY RECOMMENDED
- Configure key-board (configure\_keyboard)
- Make sure that you use all the space of the SD-card (expand\_rootfs)
- Overclock



# RPi Software



## Getting started (example Raspbian)

### Seventh step => Reboot after config

After configuration you need to reboot with the command

```
$ sudo shutdown -r now  
or  
$ sudo reboot
```

Later when you just want to shutdown the Pi you

```
$ sudo shutdown -h now  
or  
$ sudo halt
```

#### **Pay attention**

Don't plug out the micro usb-cable when the Rpi is running  
It might corrupt your SD-card



# RPi Software



## Working with the Rpi

Raspbian boots the lxde-environment (very lightweight and fast)

At the bottom you find the task bar

Left

- An application launcher
- Desktop switcher

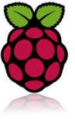


Right

- CPU-monitor
- Clock
- Desktop log-off



# RPi Software



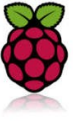
## Working with the Rpi

Application-launcher

- Browser
- System- and configuration-tools
- Office-tools
- Programming tools
- Games
- Command line
- ....



# RPi Software

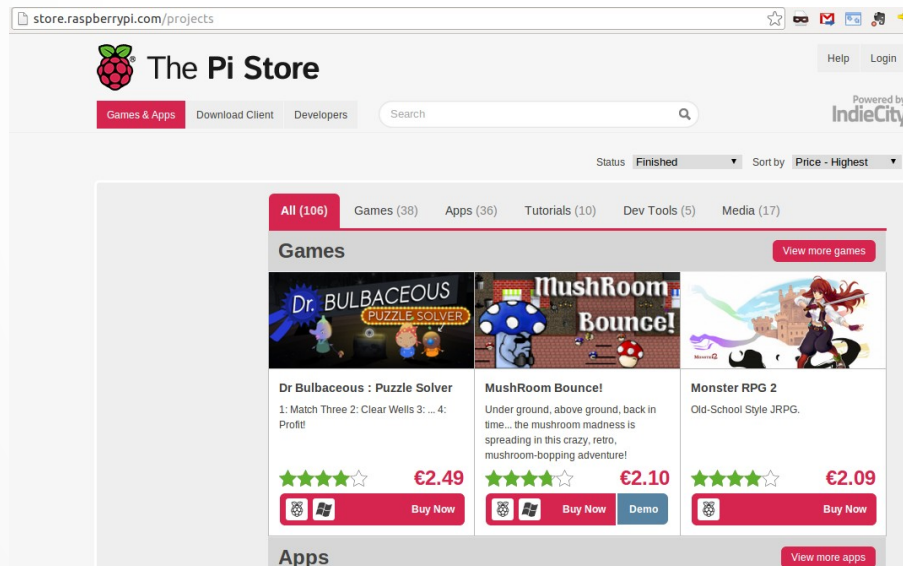


## Installing applications

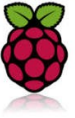
Debian installation tool apt-get

e.g. `$ sudo apt-get install chromium`

Pi-store



# RPi Software



## Using ssh to connect to your Pi via network

ssh-server is enabled by default

```
pi@raspberrypi: ~  
bart@bvpers2:~$ ssh pi@192.168.1.137  
pi@192.168.1.137's password:  
Permission denied, please try again.  
pi@192.168.1.137's password:  
Linux raspberrypi 3.6.11+ #538 PREEMPT Fri Aug 30 20:42:08 BST 2013 ar  
mv6l  
  
The programs included with the Debian GNU/Linux system are free softwa  
re;  
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.  
Last login: Mon Mar 17 23:06:06 2014 from bvpers2.home  
-bash: rt: opdracht niet gevonden  
pi@raspberrypi ~ $
```



# RPi Software



## Upgrading software and firmware

```
pi@raspberrypi: ~  
pi@raspberrypi ~ $ sudo apt-get upgrade & sudo apt-get upgrade
```

# RPi Software



## Programming the Pi

**C**

advanced system programming  
bcm-libraries simplifying RTL



## Scratch (kids)

<http://scratch.mit.edu/>  
get started



## Python

simple but powerfull  
big community

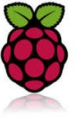


## Java

very powerfull  
fast (no as fast a c)  
libraries



# RPi Software



## Advanced stuff

### Cross-compiler toolchains

Building for RPi on another machine

Building a custom kernel

### Manipulate split memory GPU-CPU

config.txt

### Emulate the RPi

with QEMU (Linux and Windows)

### Bare metal programming

<http://www.valvers.com/embedded-linux/raspberry-pi/step01-bare-metal-programming-in-cpt1>



■ ■ ■

# RPi Software



## Interesting sites

### Support

<http://elinux.org/>

<http://www.raspbian.org/>

<http://www.raspberrypi.org>

### Store

<http://store.raspberrypi.com>

### Buying hardware

<http://iprototype.nl>

<http://antratek.be>