Introduction to the Raspberry Pi
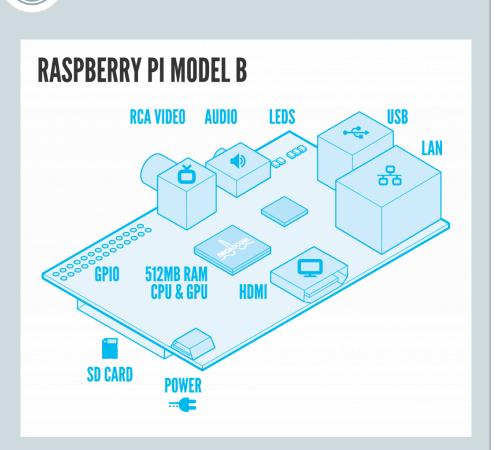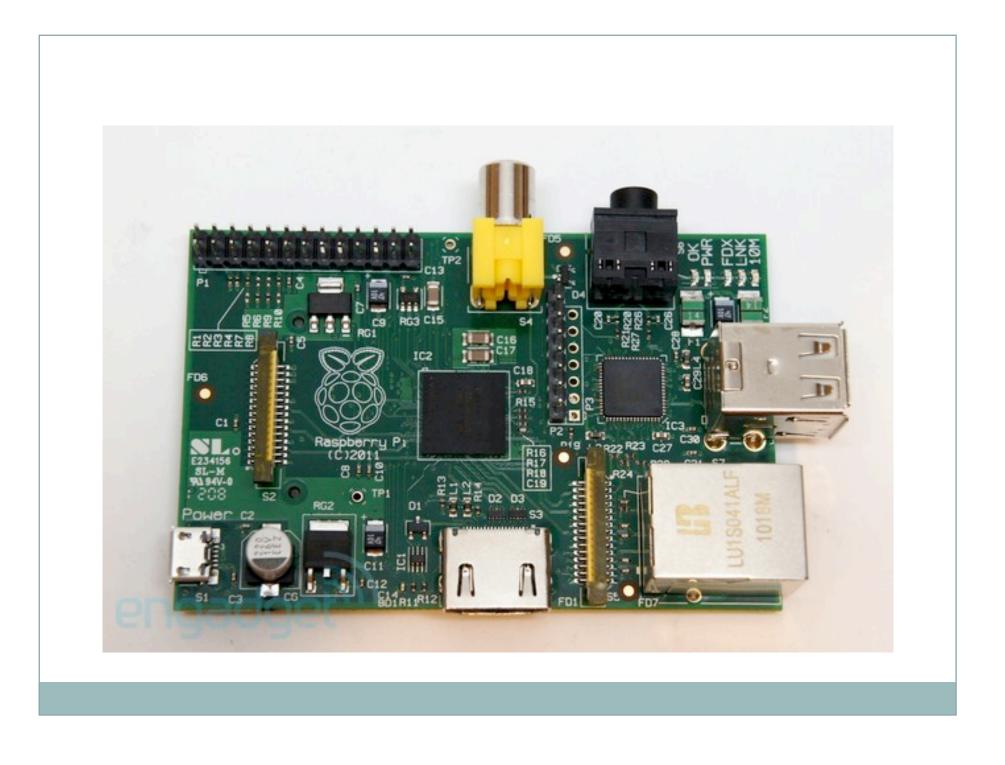
AND LINUX FOR DUMMIES

What is it???

- 700Mhz ARM v6 Broadcomm CPU+GPU
- 512 MB RAM (256MB on Model A)
- Boots off SD card for filesystem
- USB, Audio out, LAN (Model B only)
- HDMI + Composite video out
- GPIO pins
- Powered off 5V, ~700ma (500ma on Model A)

RASPBERRY PI MODEL B

RCA VIDEO   AUDIO   LEDS   USB
LAN
GPIO   512MB RAM CPU & GPU   HDMI
SD CARD   POWER

What was the point?

- Meant to be a very inexpensive, open computer to help give kids access to computers that they could experiment with, like many of us did in the 1980's.
- Hooks up to TV's, USB KB+mouse, powered off cell phone power adaptors – things many of us have already!
- SD storage so easy to reflash if you screw it up
- Linux based OS, so easy to get in and see how it works.
- Also has GPIO so possible to use for robotics!
- HUGE community following! (Not true of many of these types of devices...) Think Arduino popular... (>1M units sold in the first year...)

What sort of performance?

- Default is 700Mhz, but most will overclock to ~1Ghz
- Stock is roughly as powerful as a 400Mhz Pentium 2.
- GPU is basically as powerful as what was on the original Xbox.
- The SD interface is a bit slow, BUT you can hook up a normal mechanical HD or SSD or USB thumb drive and get a bit better performance. SD is great though because no moving parts and small.
- 100Mbit Ethernet, but it is attached through the USB interface and rarely gets full speed.

GPIO

3.3V	1	2	5V
I2C0 SDA	3	4	DNC
I2C0 SCL	5	6	GROUND
GPIO4	7	8	UART TXD
DNC	9	10	UART RXD
GPIO 17	11	12	GPIO 18
GPIO 21	13	14	DNC
GPIO 22	15	16	GPIO 23
DNC	17	18	GPIO 24
SP10 MOSI	19	20	DNC
SP10 MISO	21	22	GPIO 25
SP10 SCLK	23	24	SP10 CE0 N
DNC	25	26	SP10 CE1 N

- 3.3V (NON PROTECTED!)
- I2C, Serial, SPI, etc.
- No A/D, so no analog input
- Can do software-based PWM
- Libraries exist for interacting with the GPIO through your favorite language
- http://elinux.org/RPi_Low-level_peripherals#GPIO_hardware_hacking

Comparison to XYZ uC?
Apples and Oranges..

- Way more RAM + Storage – can do more advanced algorithms, or perform data logging.
- Can debug in place!
- Easy/quick to change program – no "reprogramming/uploading"
- Interfacing to LOTS of other hardware (webcams, etc.
- INSANE amounts of software out there for Linux, and a lot of it works on the Pi!
- Can do projects that require a GUI
- Can run and chain together multiple programs
- Network connectivity and remote access

- Not real time!
- Can be daunting if you don't know Linux
  - BIG learning curve, but really depends on what you're trying to do.
  - And remember the whole point of this thing is computer EDUCATION! GREAT platform to learn Linux on!
- X still isn't accelerated
- No A/D, no analog inputs, not protected GPIO
- Nowhere near as many pins as say, Arduino Uno to work with
- MUCH pickier about power (very narrow input voltage tolerance (4.8-5.2V)

Some other cool things…

- Can run XMBC Home Theater PC software
- Turn your TV into a Smart TV!
- Emulators for tons of old platforms (C64, Atari, NES, etc.)
- Games – OpenTTD, OpenArena, more…
- Has it's own app store…
- Several OS options – Raspbian (Debian optimized for Rpi), Debian (non-optimized), Arch Linux, RISC-OS, NetBSD – NO UBUNTU (but not a big deal)

Getting started...(with Raspbian)

- First boot will run a config program...
  - Can config settings such as the RAM mix between CPU/GPU based on your needs, overclocking, locale info, clock, etc.
- HIGHLY recommend installing "Rpi-update" (google for it) – updates software and Linux Kernel
- If you want to install more software:
  - Sudo apt-get update
  - Sudo apt-cache search "something in the name"
  - Sudo apt-get install packagename
- Doing the above will update the software available list, show you any packages that have a match for the search text, install the named package(s) and any dependencies.
- If you plan to use the desktop, install synaptic package manager for a graphical way to manage software...

Graphical Desktop

- Type: "startx"   This will launch the LXDE graphical desktop. A more "windows-ish" environment.
- You'll notice this seems slow – X (the graphical desktop foundation) hasn't been optimized (YET) to use the GPU for rendering, so has to do it with the slower CPU. Still useable though, just don't expect miracles!
- Requires you to allocate RAM to the GPU – so take with grain of salt. Takes away from system RAM.

So what else do you want to know about???

- ROS – the non-graphics (read core, important stuff) can be run, but it's a headache to get it built and working. (I have a SD card image with Fuerte on Raspbian if you want it.)

- Time for discussion!!!

Good Sources for Info

- Raspberry Pi Manual
- Raspberrypi.org + associated forums (LOTS of traffic here!)
- www.elinux.org - entire areas on this wiki for the Rpi.
- Adafruit.com/category/105 – products, tutorials, and an educational distro of Linux for the Pi.
- Youtube – TONS of Rpi related videos