COS10004 Computer Systems

Lecture 7.1 ARM Assembly Programming: Getting Ready

Dr Chris McCarthy
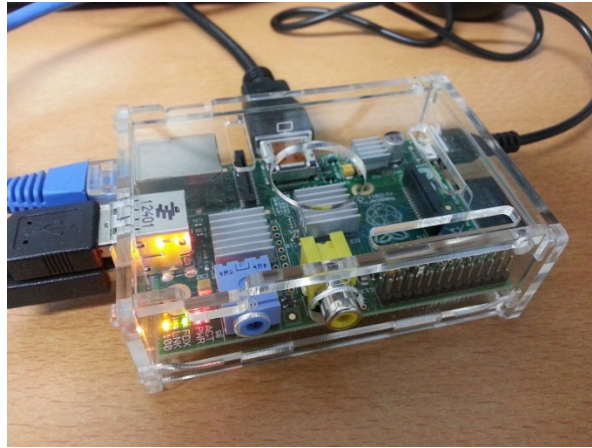
ARM Assembly

Bare-metal programming for Raspberry Pi

ACKNOWLEDGEMENTS

- This material is based on

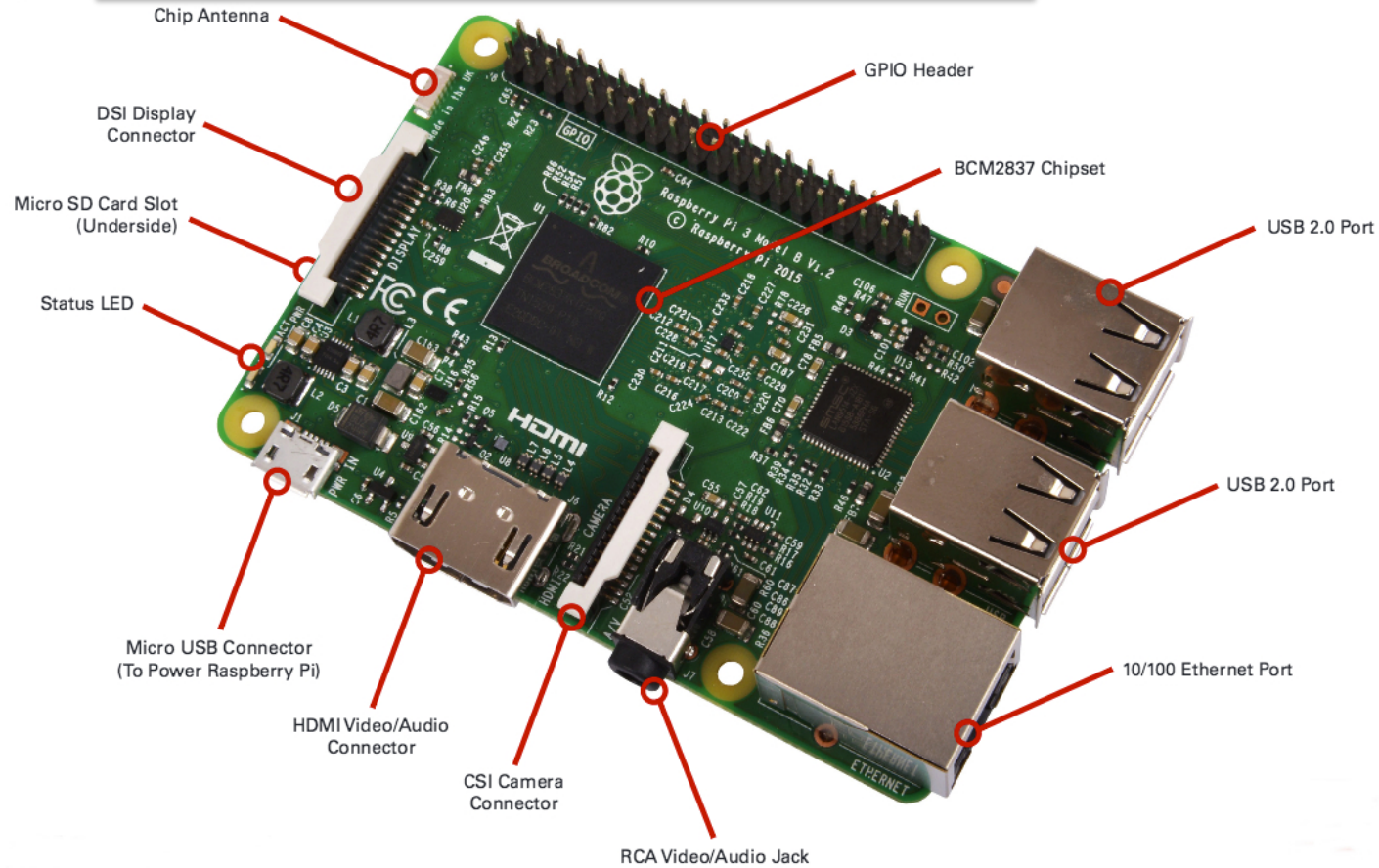**Baking Pi – Operating Systems Development** by Alan Chadwick

- http://www.cl.cam.ac.uk/projects/raspberrypi/tutorials/os/

Raspberry Pi Bare Metal Assembly Programming by Peter Lemon

- https://github.com/PeterLemon/RaspberryPi
- http://www.raspberrypi.org/forums/viewtopic.php?f=72&t=98904

MATERIALS

Raspberry Pi Model 2B/3B/3B+/4B

Src: http://www.auseparts.com.au/image//catalog/Raspi3/Raspi%203%20Layout.jpg

R Pɪ Hardware For Labs

- At least 2 male-to-female lead wires

- A breadboard

- Two LEDs (or one could also work)

- Two resistors: Any resistors from 330 up to 1K ohms are likely to be fine for standard red/green LEDs
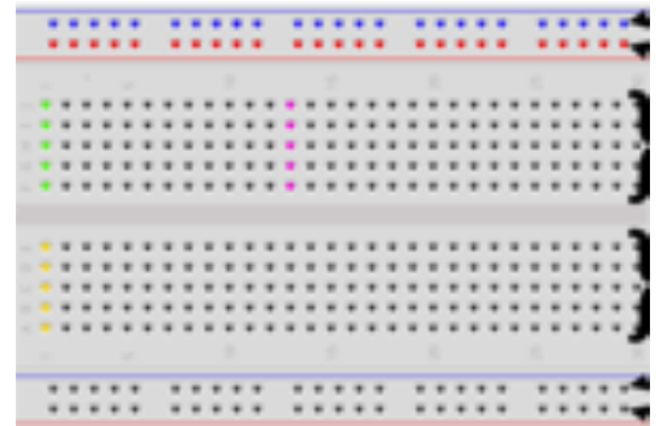
EXTRAS

- Plastic case
  - cheap on e-bay
- Heat sinks
- Power supply
  - don't buy the cheapest - try a phone charger first.
- microSD card - class 4 or 10, up to 32GB

    64GB won't work on earlier models

  - NOOBS distribution
    (free at *www.raspberrypi.org/tag/**noobs/***)

Raspberry Pi OS ''Buster''

EXTRAS

- Needed for lab extensions and OS explorations:
  - USB keyboard
  - A Screen Display with HDMI port or in combination with an HDMI adapter suitable for your screen's input port (eg HDMI to DVI/VGA
    - This is for screen writing lab in Week 10 and asm programming with operating system (these however are optional labs):
    - Note RPi 4 requires micro HDMI cable

SOFTWARE

- FASM: Flat Assembler 1.4

- http://arm.flatassembler.net/

  – Win version (1.43)

  – Linux version (download full package from [here](#), or binary from [here](#).

  – Supports B, B+ ARM1176 (ARM6 CPUs), RPi2 ARM7 and RPi3,3B,3B+ and RPi4 (ARMv8 64 bit) CPUs

- One-step compile, GUI.

- No installer (no admin rights needed).

FASMARM

- Syntax is simpler than traditional ARM ASM
  - no need for .section, _start, .global
  - native support for named constants, macros.
  - no Makefiles
- BUT
  - some ASM commands not supported.*
  - error messages not always helpful.

  *Supported commands here:

  YourDrive:\FASMARM_win32\ARMDOC\InstructionFormatsARM.asm

SUMMARY

- Bare metal assembly programming starts this week !
- This will be mostly programming without an Operating System
  - no need to install anything on your Pi!
- Get your gear!
- Get ready for some programming fun !