Teaching London Computing

Programming for GCSE Topic 5.1: Computer Components

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Aims

- Overview of computer components
- Example: Raspberry Pi
- The Universal Machine
- Performance: Clocks and Cores

From the specification

- **OCR GCSE Computing**
- Explain how common characteristics of CPUs such as clock speed, cache size and number of cores affect their performance.

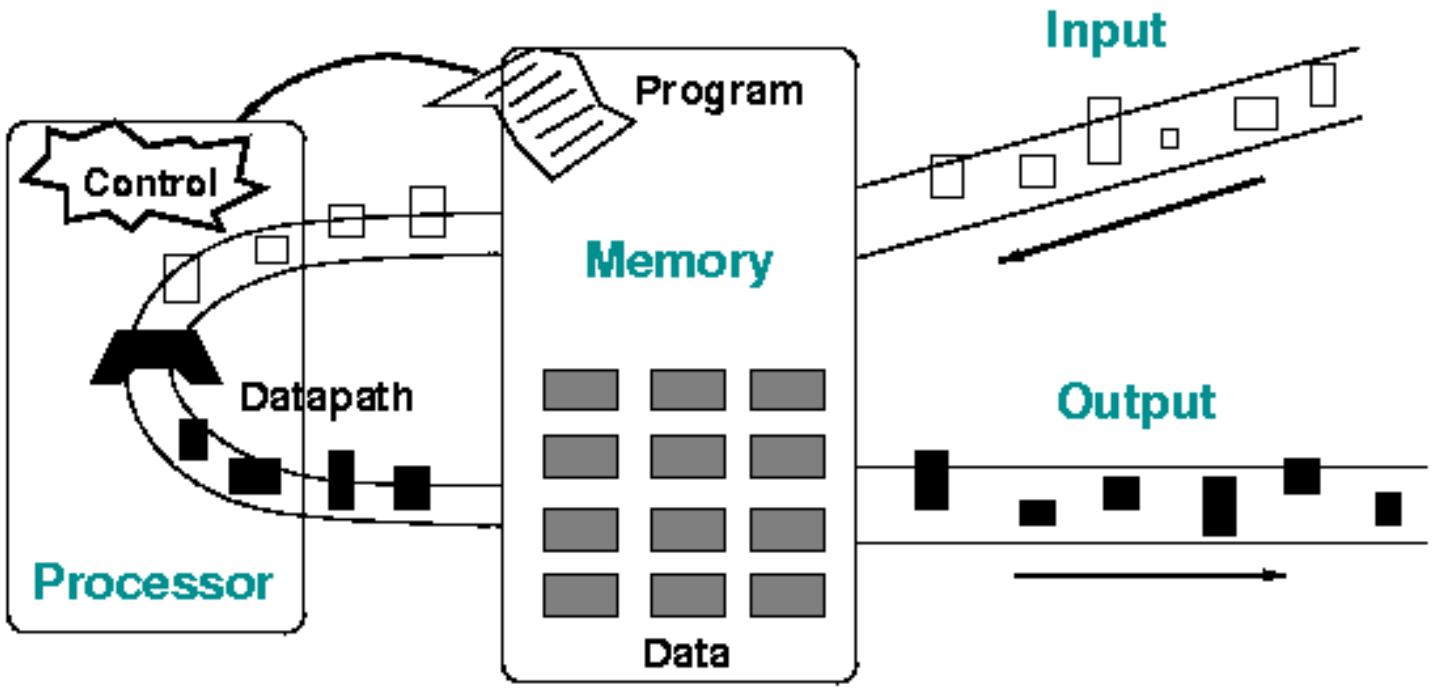
- **AQA GCSE Computer Science**
- Be able to categorise devices as input or output depending on their function

- **AQA GCSE Computer Science**
- Understand how different components link to a processor (ROM, RAM, I/O, Storage, etc)
- Be able to explain the effect of common CPU **characteristics on the performance** of the processor. These should include clock speed, number of cores …

Computer Components

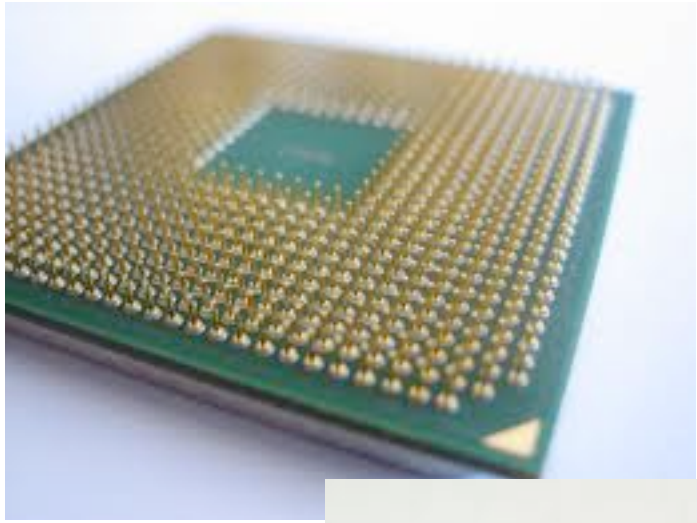
Computers

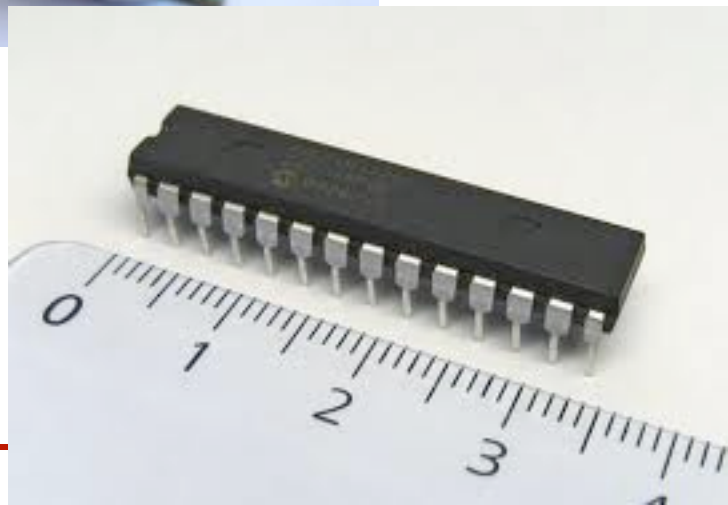
- Principal components of a computer
  - Processor
  - Memory
  - Input and Output



Processor

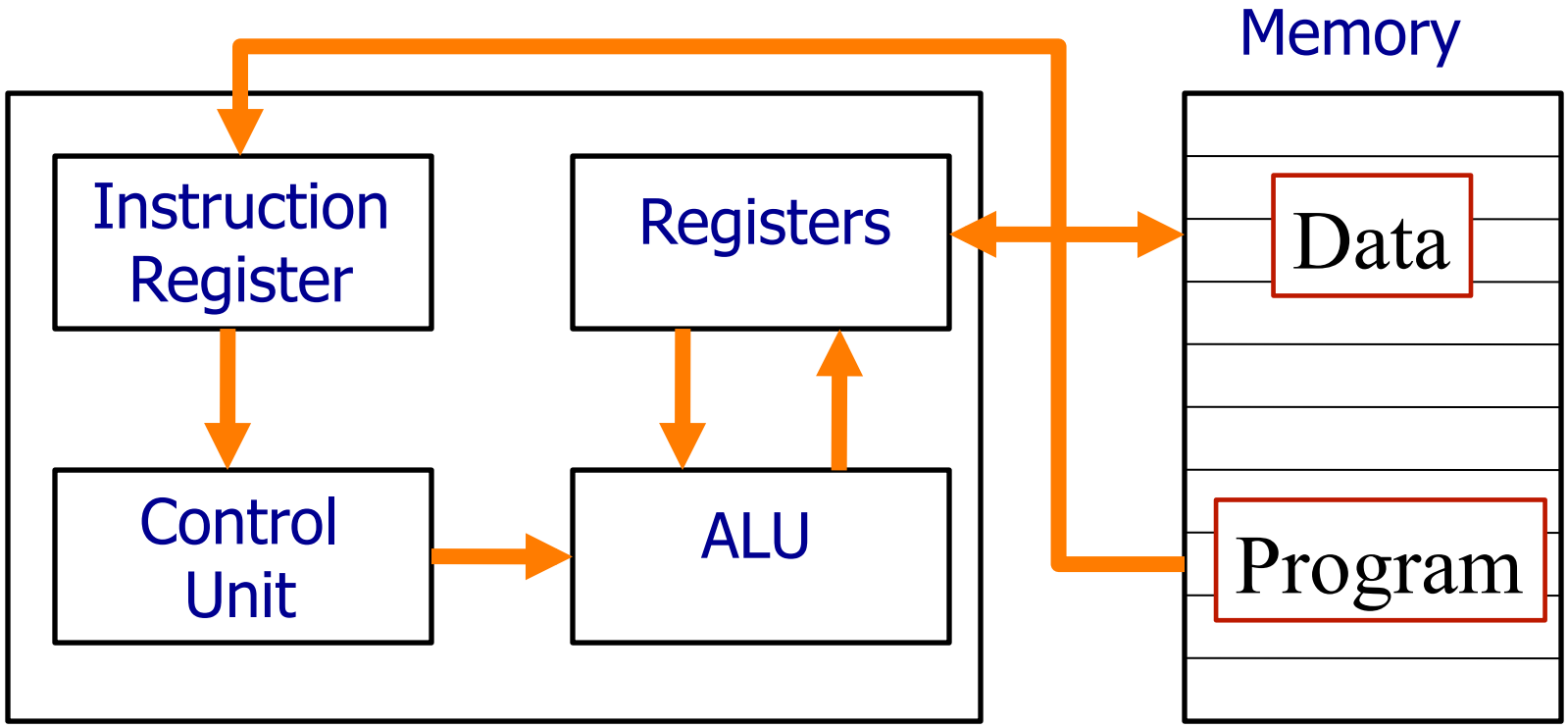
- The part that does the calculation





CPU

- Instructions and data read from memory
- Results written to memory



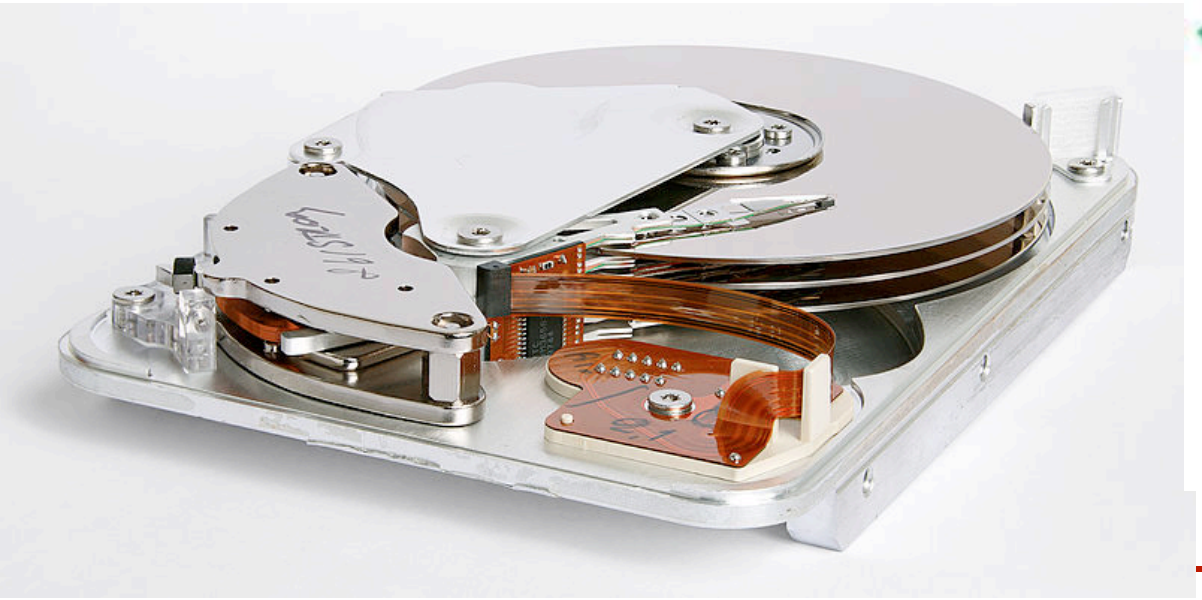
Graphics Processing Unit (GPU)

- Another computer
  - Separate card → same chip
- Best for graphics calculations
  - Games
  - Frame rate

NVIDIA.

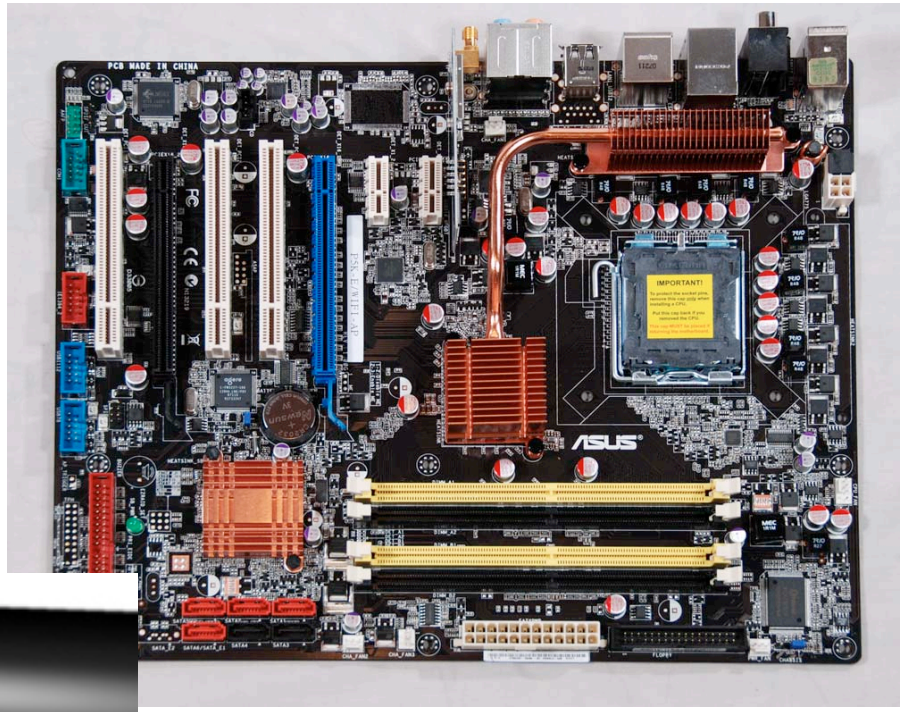
Memory

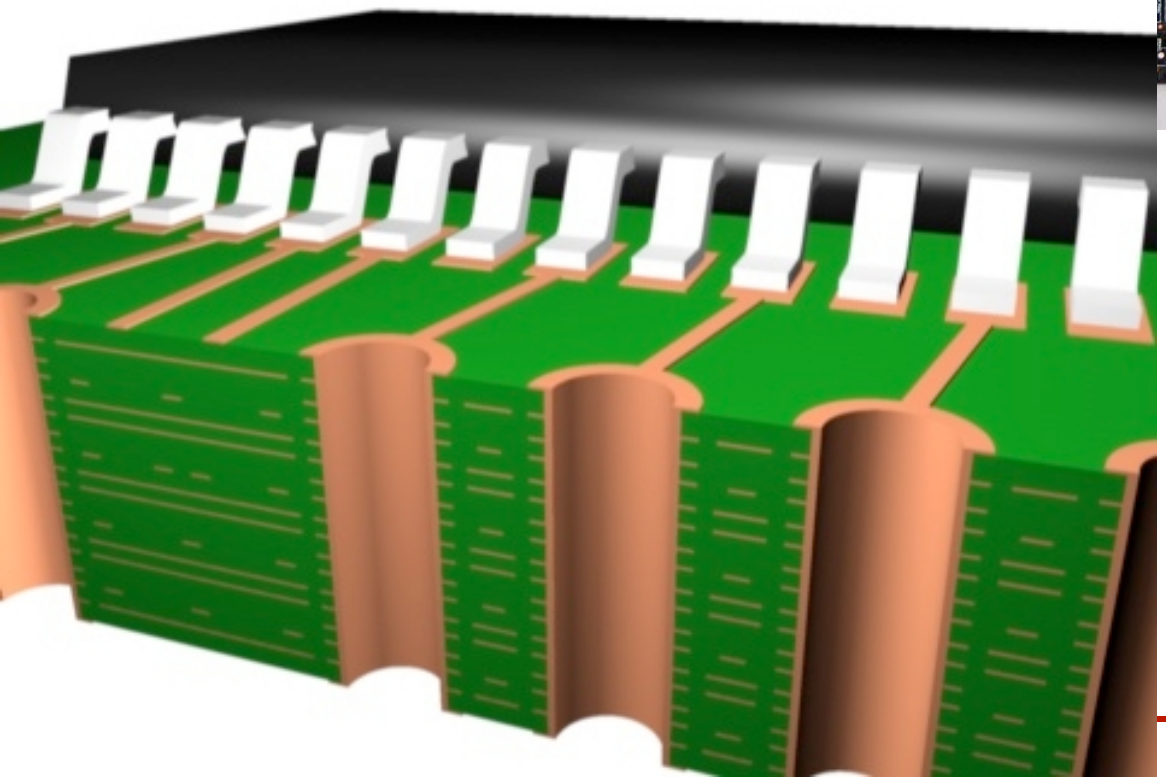
- Lots of different types
- Volatile versus permanent
- Size and performance



Motherboard

- Joins everything together
- Standards

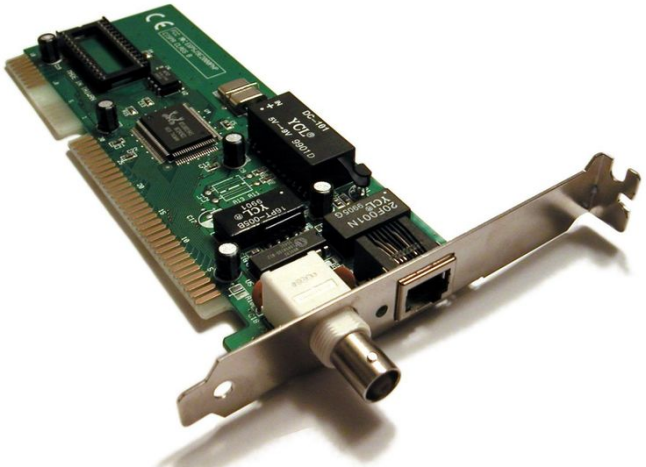




- Wires inside

Interface Devices and Cards

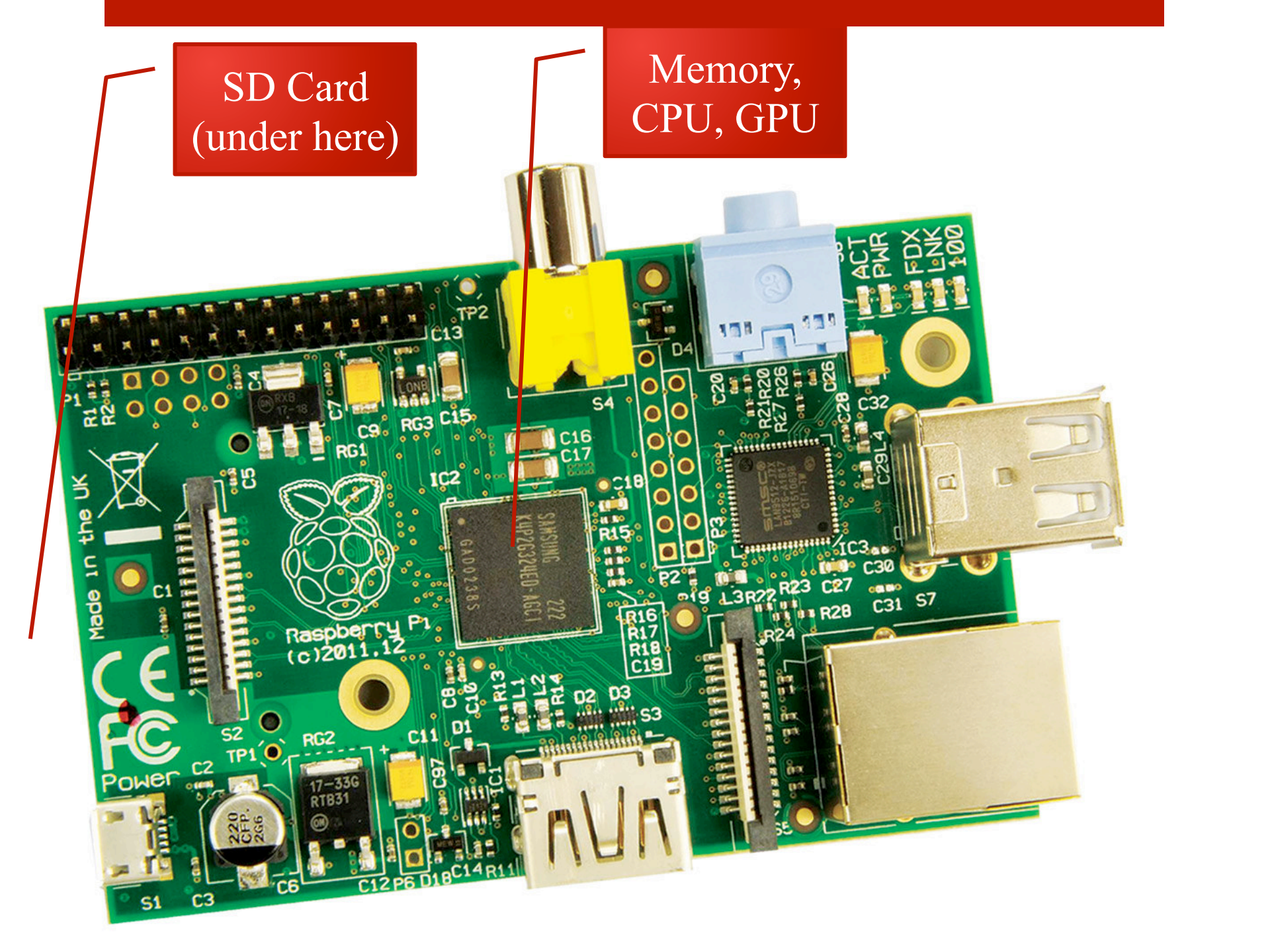
- ISA bus Ethernet card

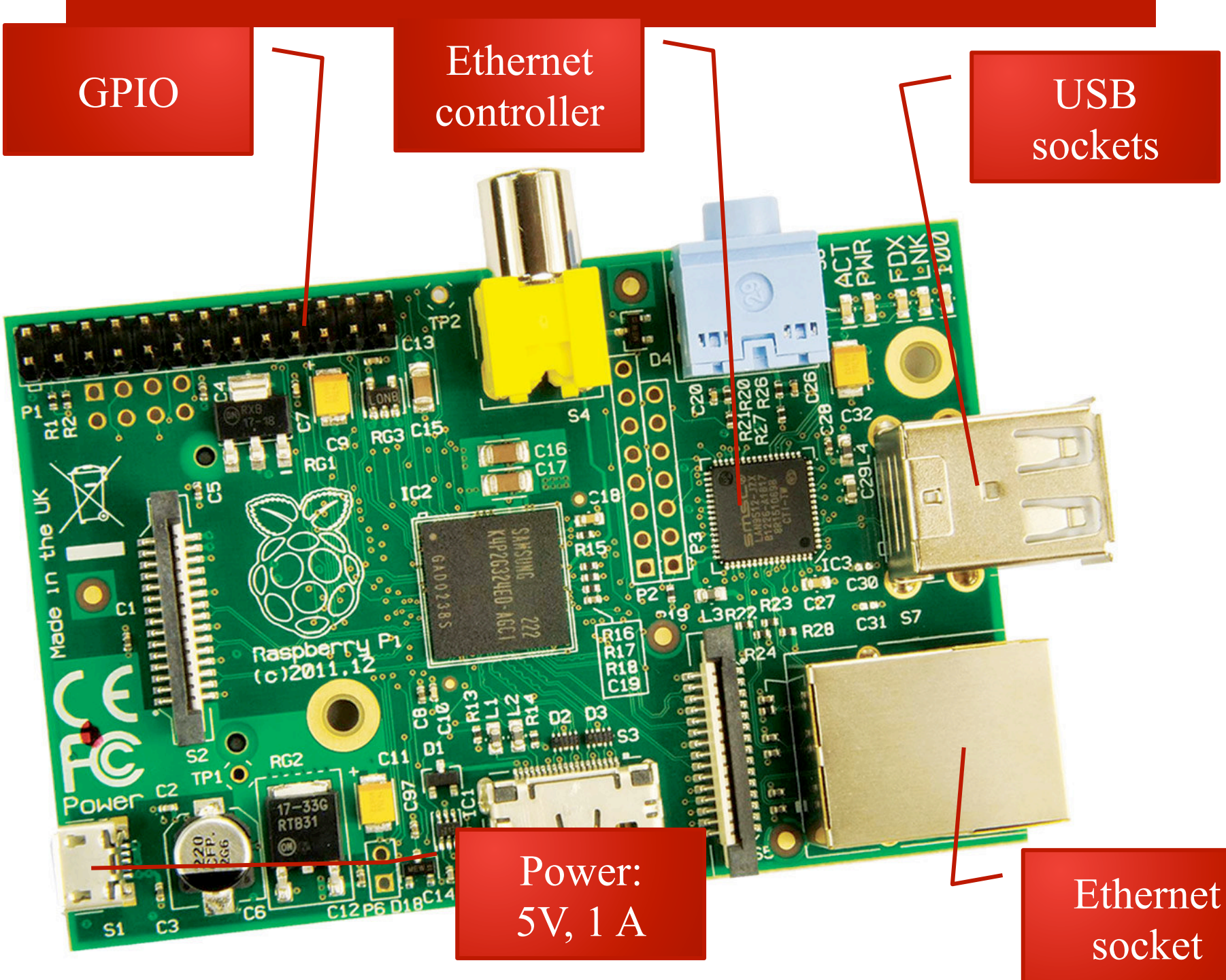


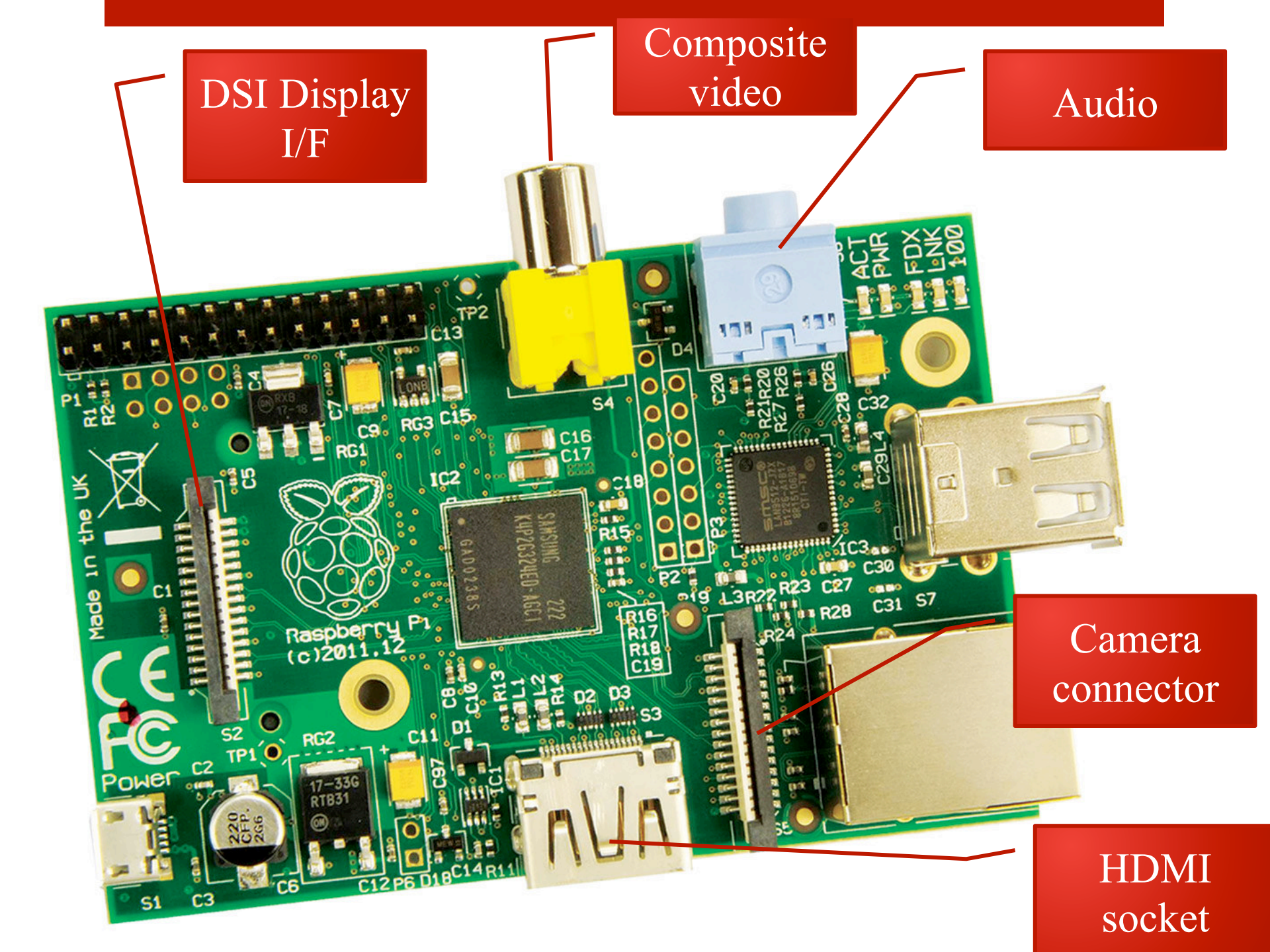
- PCI sound card
  - Sound blaster live!

Raspberry Pi

- Complete small computer
- Similar to a mobile phone


SD Card
(under here)
Memory,
CPU, GPU
Made in the UK
Raspberry Pi
(c)2011.12
Power
ACT
PWR
FDX
LNK
100
SAMSUNG
K4P2G324ED-AGC1


GPIO
Ethernet controller
USB sockets
Power: 5V, 1 A
Ethernet socket
Made in the UK
Raspberry Pi
(c)2011.12
Power

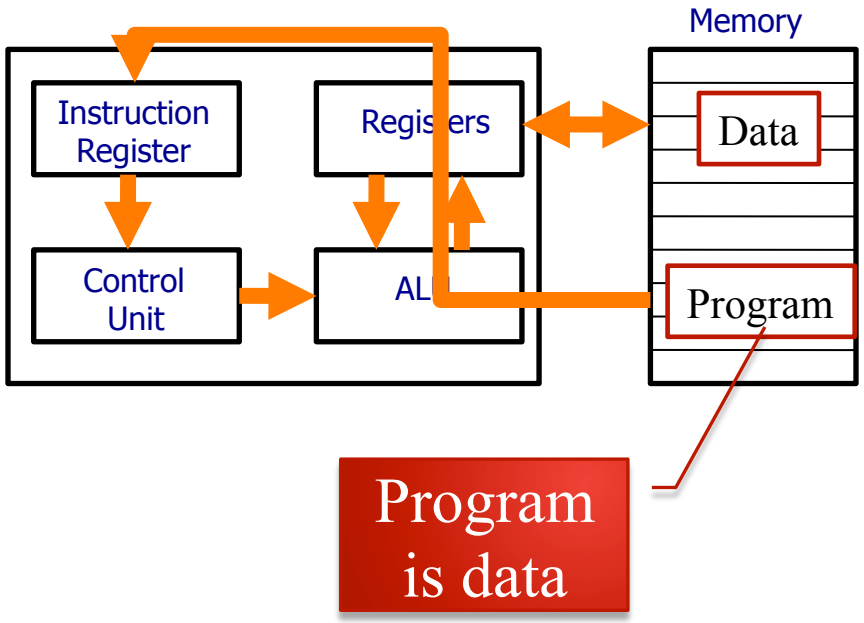

DSI Display I/F
Composite video
Audio
Camera connector
HDMI socket
Made in the UK
Raspberry Pi
(c)2011.12
Power
ACT
PWR
FDX
LNK
100

Universal Machine

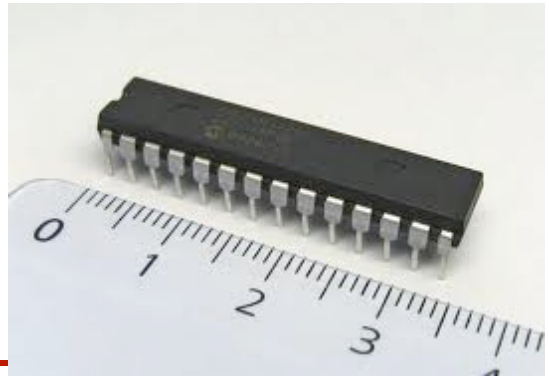
The Idea of a Stored Program Computer

What's a Computer?

- 'Do anything'
  - With a program
- 'Do nothing'
  - Without a program



- Embedded computers
  - Control, toys



Clocks and Cores

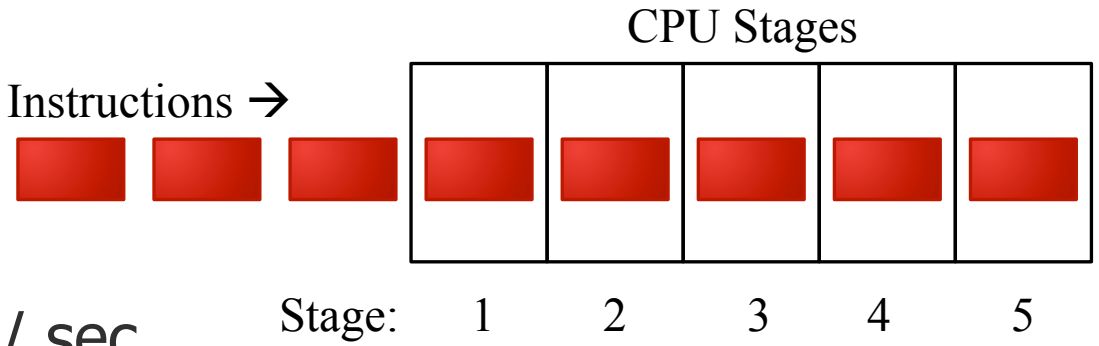
Clock Speed and Moore's Law

- CPU repeats the same cycle:
  - Fetch: gets the next instructions
  - Execute: move data according to the instruction
- Clock 'conducts' this cycle
  - First IBM PC ~ 8MHz
  - Today ~ 2 GHz
- Greater speed → more instructions per second

- Moore's law → smaller
  - … in the past this has meant faster

Pipelines and Cores

- Moore's law → more transistors
- Idea 1: pipeline
  - Like a factory
  - More instructions / sec



- Idea 2: superscalar – parallel pipelines
- Idea 3: many CPU (cores)
  - Share memory

- **Multiple cores do not make 1 program faster**

Summary – Computer

- Stored program computer
- Processor(s) – CPU and GPU
- Memory
  - Data and program
- Storage
- Idea of a universal machine
  - Computer + program
- Clock speed
  - 2 GHz → 2 x 10^9 instructions per second