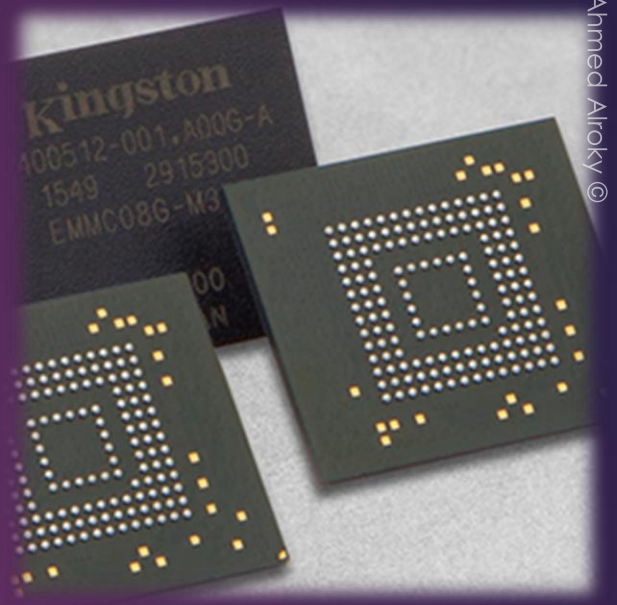
Storage and bus protocols



Microcontroller vs Microprocessor

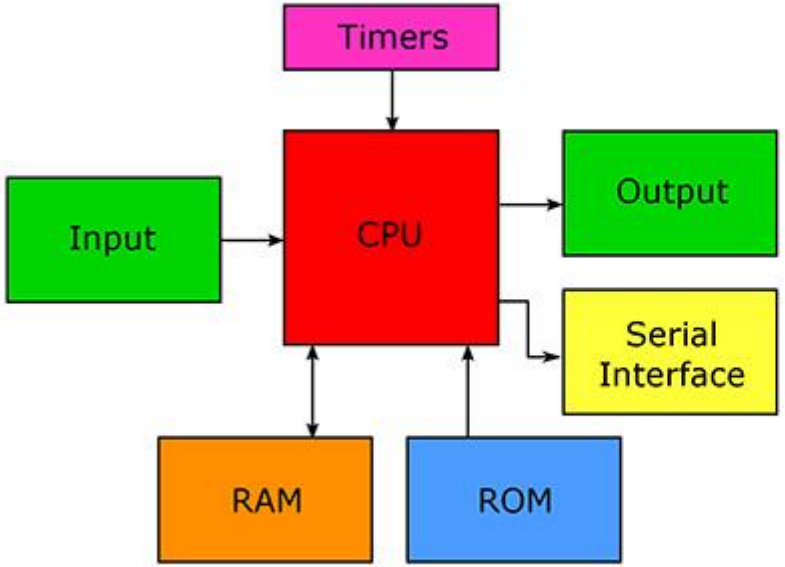
- **microcontroller**

  is a small computer on a single integrated circuit chip. A microcontroller typically contains one or more processor cores, along with additional peripherals (memory, serial interface, timer, programmable I/O peripherals, etc.) on the same chip.

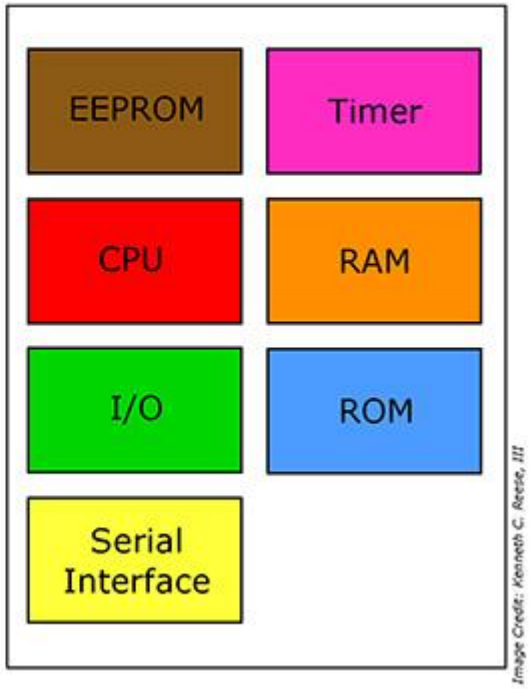
- **Microprocessor**

  is a computer processor that incorporates the functions of a central processing unit (CPU) onto just a few (and often only one) integrated circuits

Microprocesser: CPU
and several supporting chips.



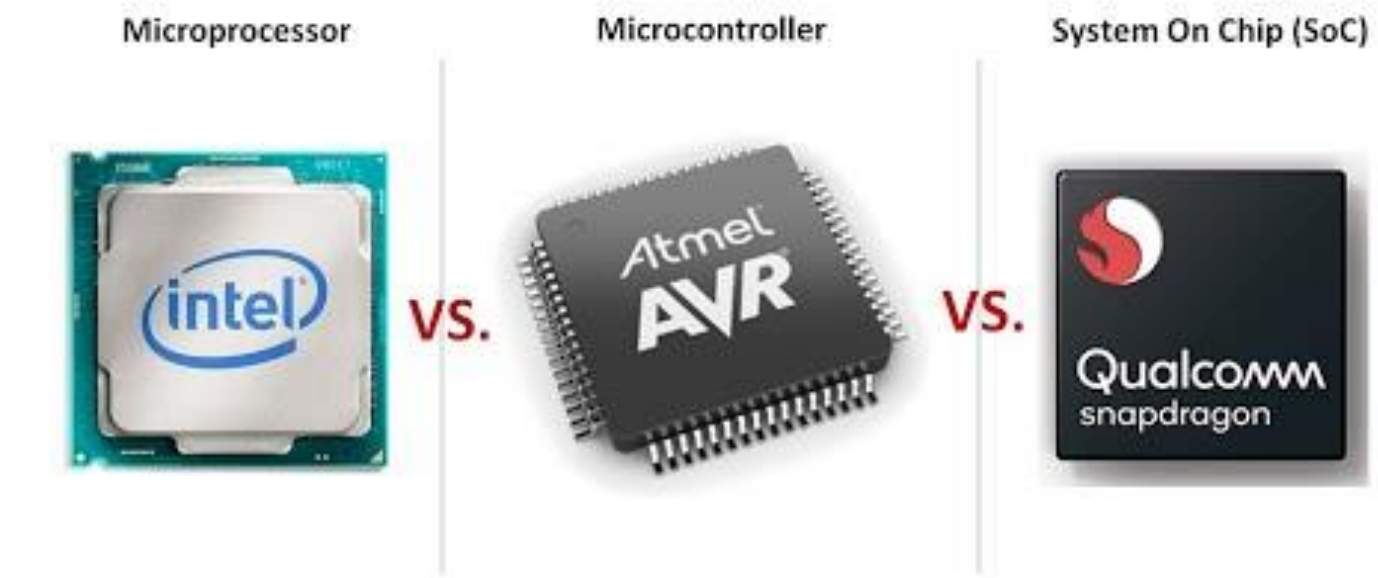
Microcontroller: CPU
on a single chip.



MCU vs SOC

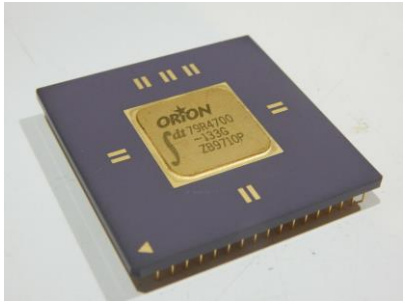
- **Microcontroller**
  - Micro-controller is a small computer on a single Integrated Circuit (IC) which contains a processor core, memory, and programmable input/output (I/O) peripherals, Timers and Counters and so on. It provides only minimal memory, interfaces, processing power etc.
  - The peripherals included on the micro-controller are lot less specific than the System on Chip. It is focused on small embedded control systems or control applications. It is sometimes abbreviated MCU.
- **System on Chip**
  - SoC is a less well defined term It is a single chip which does everything that used to take up multiple chips. A SoC is an encapsulation of one or more of CPUs, micro-controllers, DSPs, other accelerators or supporting hardware and also more specifically it does not have a specific standard about what type of circuitry it should contain. It is intended for applications with more requirements and more complex. There might be a number of micro-controllers in a SoC.
  - It is more like a complete computer system on a single chip which capable to perform complex tasks which have higher resource requirement. It is sometimes abbreviated as SoC

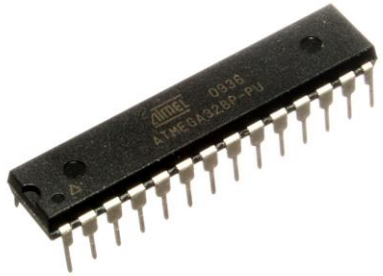
MPU vs MCU vs SOC



CPU architecture types

- **ARM**
  - Common used in : Mobile phones and IOT
  - Cortex – STM32
  - Qualcomm - snapdragon
- **MIPS**
  - Common used in : routers and network devices
  - Orion – IDT
- **AVR**
  - Common used in : Arduino boards
  - ATMEL – atmega238 , attiny85





Storage types

- Flash memory
  - Flash memory is an electronic non-volatile computer memory storage medium that can be electrically erased and reprogrammed
  - NOR and NAND flash
  - Used as : Firmware storage , Flash memory as a replacement for hard drives, Flash memory as RAM

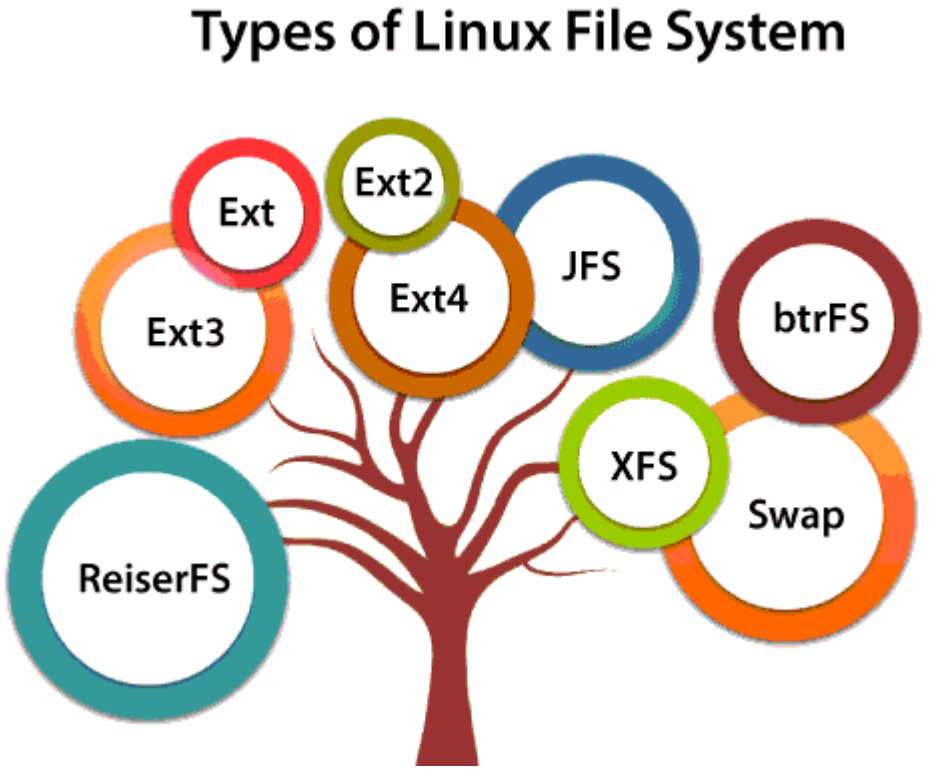
- **EEPROM**
  - electrically erasable programmable read-only memory
  - NOR cells
  - **I2C / ISP**
  - Used to store configurations
- RAM - Random-access memory
  - static RAM (SRAM) and dynamic RAM (DRAM)

Differences between EEPROM and flash memory

EEPROM	Flash Memory
Electrically Erasable Programmable Read Only Memory	Solid State Disk
NOR cells	NAND cells
Less Write More Read	Both Read Write
More Expensive	Less Expensive
Faster Read	Slower Read
More Time For Programming	Less Time For Programming
Less Voltage	More Voltage
Less Erasing Time	More Erasing Time
Erase Byte	Erase Block or Whole chip
Smaller Faster Data	Large Data

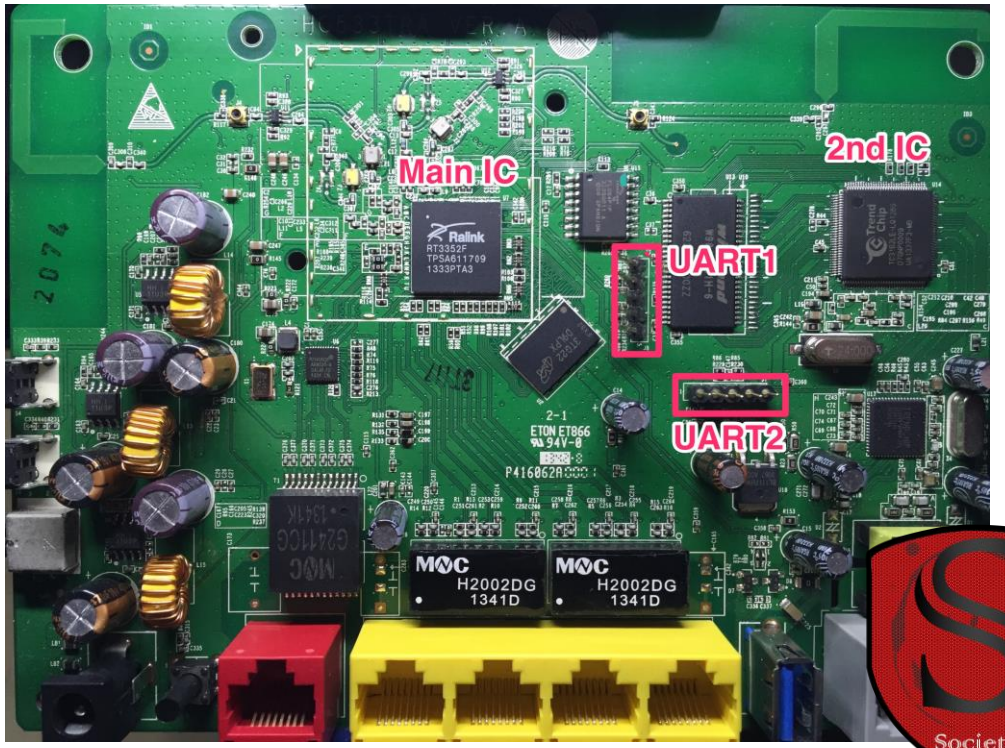
File system

- EXT2 , EXT3 , EXT4
  - Used in every *unix based system
  - Tools : mkfs.ext3
- FAT/FAT32
  - Some devices and many removable storages
- **SQUASHFS**
  - IOT and network devices
  - Tools : **mksquashfs** , **unsquashfs**
- **CRAMFS**
  - Some network devices
  - Tools : **cramfs-tools**
- YAFFS2
  - Some network devices



Bus protocols

- Transfer data between components inside device
- Most common bus protocols :
  - 1WIRE
  - Wiegand
  - I2C
  - **SPI**
    - used for short-distance communication
    - Ex : Sensors ,Camera lenses, Memory and LCD
  - CANBUS
  - **UART**
    - It's not a communication protocol like SPI and I2C, but a physical circuit in a microcontroller, or a stand-alone IC
    - Ex : GPS modules, Bluetooth modules, and RFID card reader modules

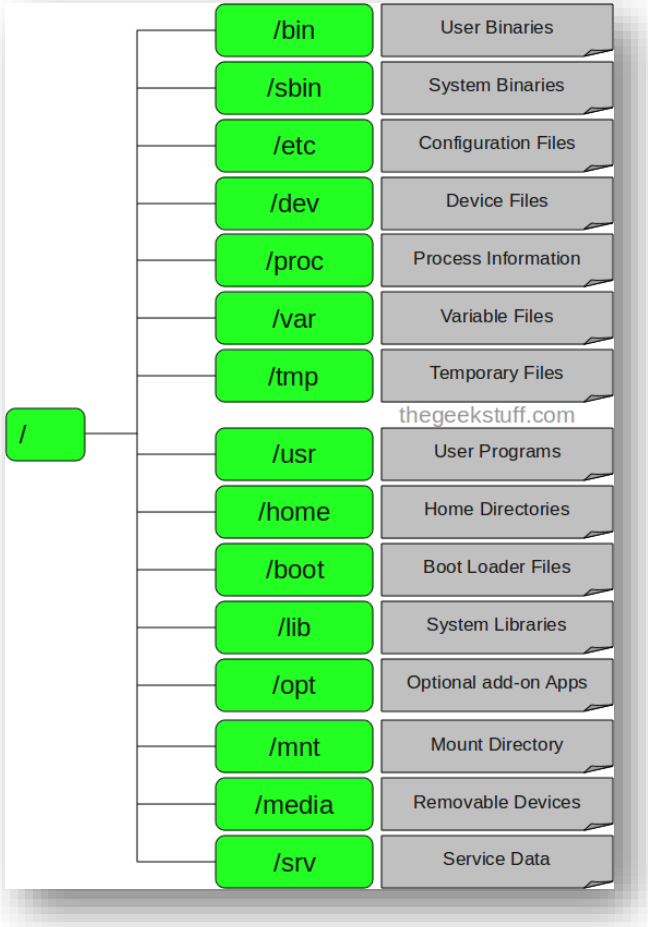


System structure

- **UBOOT**
  - Bootloader
  - Copy kernel into memory and execute
  - Supports : SD, USB, **I2C**, **SPI**, TFTP, NFS

- **ROOTFS**
  - Linux folders : bin, sbin, var, etc,

  usr, root, proc, dev, share



Now can you imagine an target ??

Good resources

- https://www.youtube.com/c/WalidIssaPlus
- https://www.youtube.com/c/LiveOverflow
- https://www.youtube.com/channel/UCoyNuc5bJ-z4X-6OlpNtJUw
- https://www.circuitbasics.com/basics-uart-communication/
- https://en.wikipedia.org/wiki/Cold_boot_attack
- EEVblog
- Attifyblog
- Hackaday blog
- https://www.totalphase.com/blog/2019/12/microcontroller-vs-microprocessor-what-are-the-differences/
- https://www.geeksforgeeks.org/difference-between-mcu-and-soc/

Thank you