IG CS Topic 4.1-4.3 Software, OS & Interrupts

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1. Types of software

- **Software Def**

  - a series of instructions written in a programing language that performs a function
- **System Software**

  - manages the hardware and software in a computer

  - Include **Operating System (OS)** and **Utility Programs**

    - **OS**

      - a program that manages the computer, allows the user to communicate with the computer, and allows software to be run
    - **Utility Programs**

      - system software that performs house-keeping activities
- **Application Software**

  - allows the user to perform an useful task

  - common application software include:

    - **word processer**

      - to create written documents
    - **spreadsheet**

      - to perform calculations on data
    - **database**

      - to store and manipulate data
    - **web browser**

      - to view and navigate websites
- **Firmware & Bootstrap**

- Firmware

  - instructions that are stored in the ROM and are loaded when the computer starts
- Bootstrap

  - the first command loaded when a computer starts, it checks hardware and loads the firmware
- **Application software** runs on **Operating system** runs on **Firmware** loaded by **Bootstrap**

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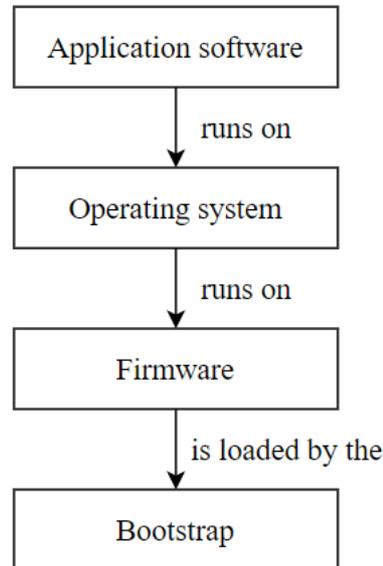
2. Functions of operating systems

- E.g. MacOS, Windows and Linux
- **Providing an interface**

  - allows the user to enter data, and outputs data to the user, all through the interface.
  - Three types of interface include
    - **Graphical User Interface (GUI)**

      - has windows, icons, menus and pointers
      - most suitable for novices, as it is often intuitive
      - requires more disk space and processes slower
      - E.g. Windows and MacOS
    - **Command Line Interface (CLI)**

      - requires the user to enter text as commands
      - useful for expert users, as commands must be exact
      - requires less disk space and processes faster
      - E.g. Linux
    - **Natural Language Interface**

      - analyzes any text commands or speak commands by the users

- **Managing files**

  - allows the user to create files (directories), move files, copy files, delete files, name and rename files, plus many other actions such as sorting by date
- **Managing peripherals and drivers**

  - allows the installation of drivers and the sending of data to and from it

  - opens, closes, and writes to peripheral devices attached to the computer

  - **Peripherals**

    - **input and output devices** that are not directly parts of the computer itself
  - **Drivers**

    - a program that controls a device and allows the software to communicate with it

    - **Descriptors in a device driver**

      - contains basic information and determines which device driver to be used
- **Managing memory**

  - transfers programs into and out of memory, allocates free space between programs, and keeps track of memory usage
- **Managing multitasking**

  - allows multiple applications to run at the same time
  - does this using interrupts
- **Managing interrupts**

  - decides which interrupt to run and then performs the actions requires
- **Managing user accounts**

  - allows the user to set-up an account, keeps the data separate for multiple accounts, and restricts the access by using the password
- **Providing a platform for running applications**

  - allows the application software to run on the computer by fetching instructions from it and executing them

3. Interrupts

- a signal to the processor to tell it that something needs its attention

- it can be software or hardware based, and aims to help managing multitasking

- **Helps Multitasking**

  - A single processor can only ever execute one instruction at a time. The processor does this so fast that it appears to be doing several tasks at one. The OS allows multitasking to happen by deciding which processes should be executed next and how long they can spend being processed before switching to another process.
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- **Examples include:**

- Hardware
    - Data input, Error from hardware & New hardware device connected
  - Software
    - Division by 0, Program requests for input, Two processes attempting to access the same memory location
- **Buffer**
  - memory areas are which stores data temporarily
  - allows transfer of data from a high-speed device such as a computer to a slower device such as a printer; allows continued use of the computer while the printer goes about its task rather than waiting until the printer is finished
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- **Interrupt handler (IH)**
  - a program that organizes interrupts into an order bases upon priorities
- **Interrupts service routine (ISR)**
  - a program that retrieves an interrupt and performs the required actions
- **Interrupt handling process**
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    - ✓ 1 A generated interrupt is placed in a queue based on priority.
    - ✓ 2 The CPU ends its instruction cycle and checks the queue for high-priority interrupt
    - ✓ 3 If there is an interrupt,
    - ✓ 4 the current process is stored and the interrupt is fetched
    - ✓ 5 the CPU checks the source of the interrupt
    - ✓ 6 it calls the interrupt service routine (ISR)
    - ✓ 7 the interrupt is serviced and the CPU returns to previous process or service another interrupt
    - ✓ 8 If there is no interrupt,
    - ✓ 9 it performs another fetch-decode-execute cycle.