# 2016 Web Systems Notes

Operating Systems

- **Operating System:** *A software that interfaces between programs and the computer's hardware, managing the computer, running programs, interfacing between the user and hardware, providing services to users and programs, and protects users and programs from each other.*

  - Types of Systems

    - Mainframes > Minicomputers > Personal Computers > Embedded Systems

  - Layers of a System

    - **Hardware:** *Refers to physical components of a computer, including the CPU, memory, I/O and storage.*

    - **Kernel:** *This controls the hardware directly, providing resources and services to applications as well as managing access to privileged resources.*

    - **Apps:** *Refers to applications and services, often known as 'user-land'.*

    - **CLI:** *Command line interfaces, such as the terminal, where users have access to a set of commands known as a 'scripting language'.*

      - **Scripting Language:** *Examples include Python, Bash, and Pearl. They are often inconsistent, interpreted, and have untyped variables. CLI's can be automated with Batch files that automate lines of script.*

    - **GUI:** *Refers to a user-friendly interface on top of the OS that will run shell-commands transparently, sometimes being a web interface. Psychology, consistency, workflow, audience and polish are all considered when building these.*

- **UNIX:** *Has been a highly popular, 'C-based' OS since 1969, and is used in everything from mainframes to embedded systems. It is fast and stable, and most distributions are open source.*

  - IEEE's POSIX standard was largely ignored while more recently, SUS became the standard.

  - Being based in C means that it is not tied to a particular CPU architecture.

  - Unix is based on the principle that everything is a file, permission, process or user, allowing it to be infinitely extensible.

- **Filesystem:** *Refers to the part of an operating system that manages data storage and access this data is typically stored on a physical storage device, such as a hard drive.*

  • **Physical Filesystem:** *Pertains to how logical items are physically represented and stored.*

    - Disk Physical Structure

      • **Tracks:** *Platter rings.*

      • **Cylinders:** *Tracks on a platter.*

      • **Sectors:** *A part of a track for data.*

      • **Heads:** *Data readers.*
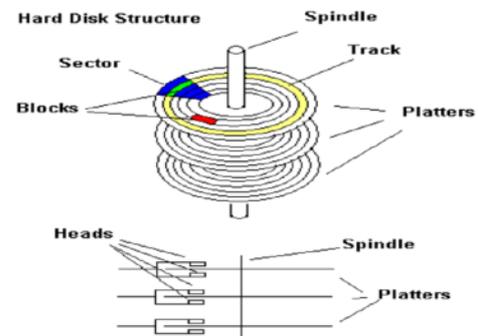
      • **Formatting:** *Creates the physical disk structure, marking surfaces on the disk into tracks, sectors and cylinders*

  • **Logical Filesystem:** *Include files, directories/sub-directories and partitions.*

    - **Partitions:** *Divide disks into seperate devices.*

    - **Blocks:** *The OS recognises these as the smallest amount of data to transfer in a fixed-size logical array, with each file being at least one or more blocks in size.*

    - **Directories:** *Tables used to locate blocks used by files on the OS.*

    - **File Allocation:** *The OS uses directories to map out where files exist within the system, referring to its location and size in blocks. The speed of getting to the file is determined primarily by its allocation method:*

      • **Contiguous O(1):** *Where each file is placed at the time of creation, one after the other. While supporting random access, it is also a poor use of space.*

      • **Chained O(n):** *A linked list of blocks, where each block contains data and a pointer to the next block. Supporting sequential access, it is very slow sometimes.*

      • **Indexed O(log(n)):** *A tree-based allocation system, where 'index' data blocks contain the number of data blocks for each file. In UNIX, this system is used where, data is stored on 'iNodes' that contain file metadata and pointers.*