Study Guide: Ch.1 - Introduction

- An OS is a program that acts as an intermediary between a user of a computer and the computer hardware.
- Goals: Execute user programs, make the computer system easy to use, utilize hardware efficiently.
- Computer system: Hardware ↔ OS ↔ Applications ↔ Users.
- OS is:
  - Resource allocator: decides between conflicting requests for efficient and fair resource use.
  - Control program: controls execution of programs to prevent errors and improper use of computer.
- Kernel: the one program running at all times on the computer.
- Bootstrap program: loaded at power-up or reboot.
  - Stored in ROM or EPROM (known as firmware), Initializes all aspects of system, loads OS kernel and starts execution.
- I/O and CPU can execute concurrently.
- Device controllers inform CPU that it is finished with operation by causing an interrupt.
  - Interrupt transfers control to the interrupt service routine generally, through the interrupt vector, which contains the addresses of all the service routines.
  - Incoming interrupts are disabled while another interrupt is being processed.
  - Trap is a software generated interrupt caused by error or user request.
  - OS determines which type of interrupt has occurred by polling or the vectored interrupt system.
- System call: request to the operating system to allow user to wait for I/O completion.
- Device-status table: contains entry for each I/O device indicating its type, address, and state.
  - OS indexes into the I/O device table to determine device status and to modify the table entry to include interrupt.
- Storage structure:
  - Main memory – random access, volatile.
  - Secondary storage – extension of main memory that provides large non-volatile storage.
  - Disk – divided into tracks which are subdivided into sectors. Disk controller determines logical interaction between the device and the computer.
- Caching – copying information into faster storage system.
- Multiprocessor Systems: Increased throughput, economy of scale, increased reliability.
  - Can be asymmetric or symmetric.
  - Clustered systems – Linked multiprocessor systems.
- Multiprogramming – Provides efficiency via job scheduling.
  - When OS has to wait (ex: for I/O), switches to another job.
- Timesharing – CPU switches jobs so frequently that each user can interact with each job while it is running (interactive computing).
- Dual-mode operation allows OS to protect itself and other system components – User mode and kernel mode.
  - Some instructions are only executable in kernel mode, these are privileged.
- Single-threaded processes have one program counter, multi-threaded processes have one PC per thread.
- Protection – mechanism for controlling access of processes or users to resources defined by the OS.
- Security – defense of a system against attacks.
- User IDs (UID), one per user, and Group IDs, determine which users and groups of users have which privileges.