Chapter 1
What is UNIX?

Graham Glass and King Ables,
UNIX for Programmers and Users,

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Computer Systems

- Computer System: Hardware + Software

- Hardware: CPU, Memory (RAM/ROM), Disk drives, CD-ROM drives, Monitor, Graphics card, keyboard, Mouse…

- Software: Operating System, Application programs

- UNIX is the name of a popular operating system
Computer Systems

- Random Access Memory (RAM): Any byte of memory can be accessed without touching the preceding bytes.
- Read Only Memory (ROM): can only be modified slowly, with difficulty, or not at all.
Typical Personal Computer System
Hardware Key Component (1)

CPU and Main Memory

Central Processing Unit

Main Memory

- Chip that executes program commands
  - Intel Core i3, i5, i7

Primary storage area for programs and data that are in active use

Synonymous with RAM (Random-Access Memory)
Hardware key Components(2)
Secondary Memory Devices

- Secondary memory devices provide long-term storage.
- Information is moved between main memory and secondary memory as needed.
- Hard disks, DVD-RW, USB Drive
Hardware Key Components (3)
Input/Output Devices

- I/O devices facilitate user interaction
- Monitor, Keyboard, Mouse, Printer, Scanner…
Computer Network
Software Component

- **Applications**
- **Operation System**
  - API: application program interface
  - File management
  - I/O
  - Kernel
    - Memory management
    - Resource Scheduling
    - Program communication
    - Security
- **Network Module**
Software Categories

• **Operating System**
  - Controls all machine activities
  - Oversee operation of computer - store and retrieve files
  - Schedule programs for execution - coordinate the execution of programs - provides the user interface to the computer
  - Manages resource such as the CPU and memory

• **Application program**
  - Generic term for any other kind of software
  - Word processors, missile control systems, games

• **Most operating systems and application programs have a graphical user interface (GUI)**
The shell as an interface between users and the operating system
The booting process

**Step 1:** Machine starts by executing the bootstrap program already in memory. Operating system is stored in mass storage.

**Step 2:** Bootstrap program directs the transfer of the operating system into main memory and then transfers control to it.
UNIX is an operating system

- Provides a framework for executing programs and storing files
- File: collection of data normally stored on disk
- Program: collection of instructions/data that is stored in a file
Unix API - the system calls

- Ultimately everything works through system calls
Process

• When a program is executed, it is loaded into memory. It is called a process when it is executing.

• Most processes read/write data from/to files.

• Processes and files have an owner.

• UNIX supports hierarchical directory structure.

• Files and processes have a location within the directory structure.

• UNIX provides the capabilities to create, modify, and destroy files, program, and processes.
UNIX Attributes

- Sharing of resources: CPU (times slices), memory (pages), disk (blocks)

- Communication: process-device controller, process-process, etc. (pipes 1-way, sockets 2-way)

- Utilities: UNIX comes with a large collection of utilities. We will study many of these.

- Programmer support: all kinds of compilers available.

- Access to parallel processing, file handling, and interprocess communication via System Calls in C.
Advantages of UNIX

- It is multitasking, therefore, multiple programs can run at one time.

- It is multiuser, allowing more than a single user to work at any given time. This is accomplished by sharing processing time between each user and utilizing distributed computing systems.

- It is safe, preventing one program from accessing memory or storage space allocated to another, and enables protection, requiring users to have permission to perform certain functions, i.e. accessing a directory, file or disk drive.
The UNIX Family Tree

The Unix Family Tree

UNICS (1969)
  
Fifth Edition (1973)
  
Sixth Edition (1976)
  
Seventh Edition (1978)

SVR5 (1983)
  
SunOS 5.x/Solaris (SUN)
  
HP-UX (HP)
  
AIX (IBM)
  
IRIX (SGI)
  
Digital UNIX (formerly OSF/1) (DEC)

BSD (1979)
  
SunOS 4.x (SUN)
  
ULTRIX (DEC)
  
NextStep (NeXT)

DEC
Two Main Varieties of UNIX

- System V (AT&T) and
- BSD (Berkeley Standard Distribution)
  - Both are merged now. SunOS, IRIX, AIX, HP-UX have features from both varieties although most are System V UNIX.

- Other UNIX versions you may have heard of:
  - Sun Java Desktop OS, Solaris
  - Apple OS X

- UNIX-LIKE
  - Linux (Fedora, Red Hat, Ubuntu, SUSE, etc.)
Sub-Varieties of UNIX

- Linux (Runs on PC architecture) - UNIX-LIKE
  - Fedora
  - Red Hat
  - Ubuntu
  - Sun Java Desktop OS, etc
- Sun Solaris (Runs on SPARC architecture)
- Apple OS X (Runs on Mac and Intel platform)
Philosophies of UNIX

• **Pipe mechanism**
  
  • Output of one process can be used as input for another process. e.g.
    
    • `$ who | sort`
  
  • Using the pipe mechanism, complex tasks can be broken down into simpler ones and combined using pipes etc.

• **Super user**
  
  • User who has complete control over the system resources. Typically the System’s Administrator.
Review

• Computer Systems
• UNIX as an operating system
• Processes
• UNIX Attributes
• UNIX Varieties
• UNIX Philosophies