



CHAPTER 1

What Is Unix?

Computer Systems

- ▶ **Hardware + Software**
- ▶ Computer hardware is useless without software.
- ▶ Hardware
 - a central processing unit(CPU),
 - memory,
 - disks,
 - a monitor, and
 - a keyboard.

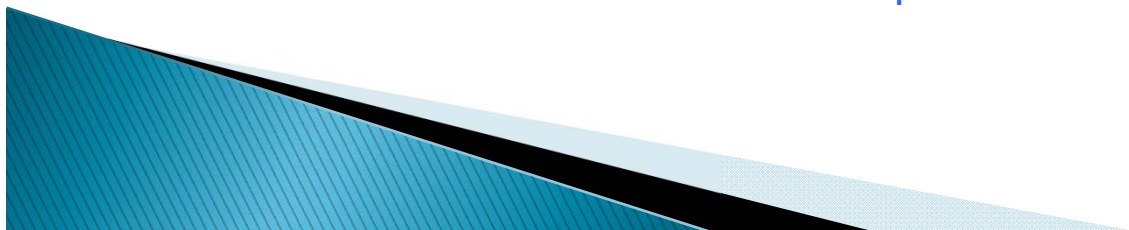
Computer Hardware

- ▶ Computer systems, whether large or small, **multiuser or single user**, expensive or cheap, include most of the following pieces of hardware:
- ▶ **Central processing unit (CPU)**
 - reads **machine code** (instructions) from memory and executes it.
 - **the “brain” of a computer.**
- ▶ **Random-access memory (RAM) – Primary Memory**
 - holds **machine code and data** that are accessed by the CPU.
- ▶ **Read-only memory (ROM) – Secondary Memory**
 - holds both **machine code and data.**
- ▶ **Disk – Secondary Memory**
 - large amount of data and code
 - magnetic or optical medium
 - **Floppy disks**
 - **Hard disks**



Computer Hardware

- ▶ **CD-ROM drive – Secondary Memory**
- ▶ **Monitor**
 - displays information
- ▶ **Graphics card**
 - allows the CPU to display information on a monitor.
- ▶ **Keyboard**
 - allows a user to enter alphanumeric information.
- ▶ **Mouse**
 - allows a user easily to position cursors, icons, graphics, text, and other items on the screen by using short movements of the hand.
- ▶ **Printer**
 - allows a user to obtain hard copies of information.



Computer Hardware

▶ Tape

- backup copies of information stored on disks.

▶ Modem

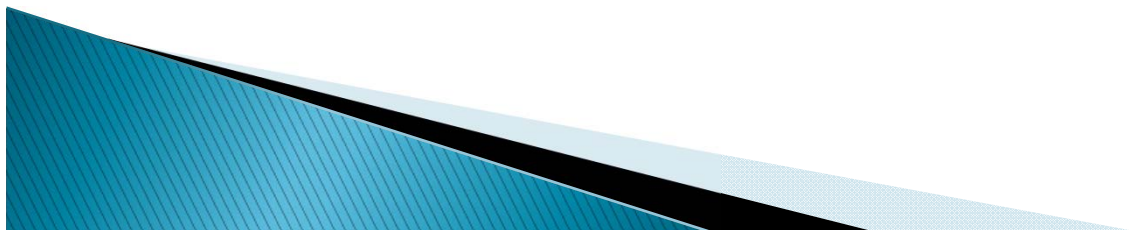
- allows the user to communicate with other computers across a telephone line.

▶ Ethernet interface

- allows computers to communicate at high speeds.
- Computers attach to an Ethernet by a special piece of hardware called an Ethernet interface.

▶ Other peripherals

- many other kinds of peripherals that computer systems can support, including:
 - graphics tablets,
 - optical scanners,
 - array processors,
 - sound cards,
 - voice recognition cards,
 - usb, etc.



Computer Software

- ▶ Without its software, a computer is useless.
- ▶ With its software, a computer can store, process, and retrieve information, and engage in many other valuable activities.
- ▶ Computer software
 - system programs that manage the operation of the computer itself,
 - application programs, which solve problems for their users.



Computer Software

▶ Operating System

- most fundamental of all the system program
- controls all the computer's resources
- provides the base for the application programs
 - DOS, Windows, Linux, MacOS, Android, and etc.

▶ Unix is a popular operating system.

- It is most commonly used in backend applications, on servers, powerful workstations, etc.
- One of the most well-designed operating systems of its time.
- UNIX is available for virtually all platforms.

▶ Linux and MacOS X (basically a BSD Unix) are popular desktop alternatives to MS Windows.



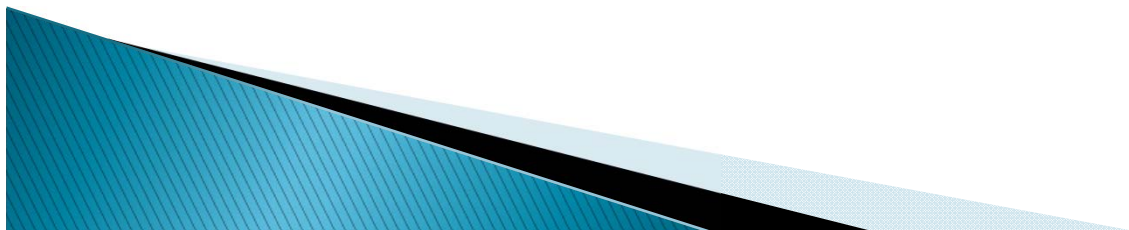
Operating Systems

- ▶ An operating system

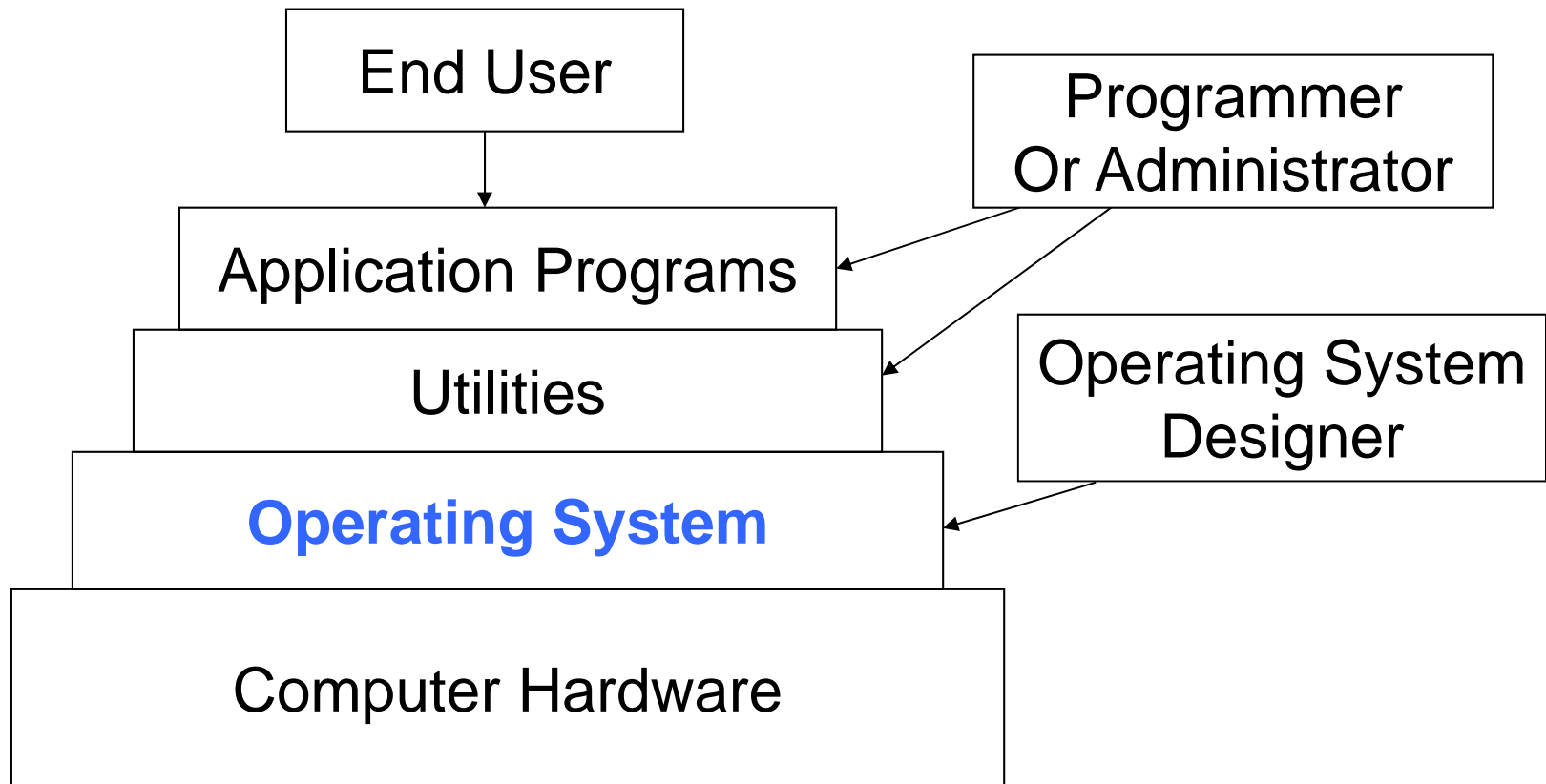
- a program that controls the execution of application programs and acts as an interface between the user of a computer and the computer hardware.

- ▶ An operating system has four major components:

- process management,
- input/output,
- memory management, and
- the file system.
- communication



Layers and Views of a Computer System



What Unix is

- ▶ Common Operating System
- ▶ Open Platform
- ▶ Runs on Many Machines
- ▶ Widely Used

- ▶ Features
 - Time sharing
 - Multiuser
 - Networking
 - Interactive

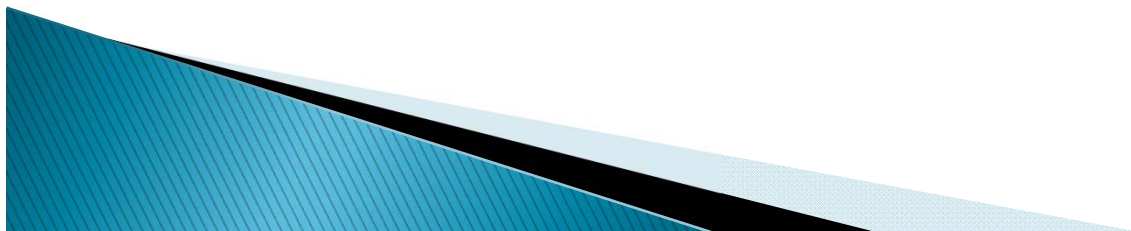
- ▶ Inspired by Multics



So... you want to be a ...

▶ System Administrator?

- ▶ You must have a high tolerance for pain and/or abuse. Everything that goes wrong is your fault. Things that go right– well that's what they pay you for.
- ▶ Your networking skills should be strong.



So... you want to be a ...

▶ System Administrator?

- ▶ You must be adept at reading minds as most users don't have a clue about what they really want.
- ▶ You can't suffer from techno-phobia. If you don't like seeing new technical problems every day, being a SysAdmin probably isn't for you.



So... you want to be a ...

▶ System Administrator?

- ▶ You must be able to drop whatever you are doing at a moments notice and handle a crisis without showing fear. If the SysAdmin shows fear, you can create an OFFICE PANIC.
- ▶ You must be able to THINK in pressure situations. No one cares how you FEEL about a bad hard drive—they just want you to fix it.



Unix Utilities

- ▶ Standard UNIX comes complete with at least 200 small utility programs
 - shells,
 - editors,
 - a C compiler,
 - matching with regular expressions,
 - searching,
 - a sorting utility,
 - software development tools,
 - text-processing tools, etc.
- ▶ Graphical User Interfaces
 - based on X Windows.
 - The most popular: CDE, Gnome, KDE.
- ▶ Popular packages like spreadsheets, compilers, and desktop-publishing tools are also commercially available.



Programmer Support

- ▶ Unix is an “open” system, which means that the internal software architecture is well documented and available in source-code form for a relatively small fee.
- ▶ Features of UNIX such as parallel processing, inter-process communication, and file handling are all easily accessible from a programming language such as C via a set of library routines known as system calls.



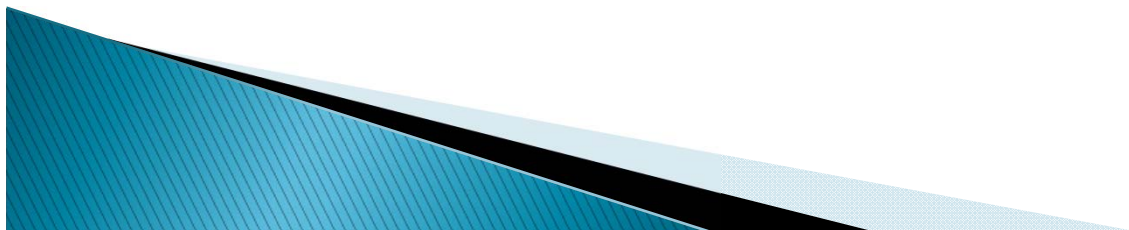
Summary of Unix Features

- ▶ It allows **many users** to access a computer system at the same time.
- ▶ It supports the creation, modification, and destruction of **programs, processes and files**.
- ▶ It provides **a directory hierarchy** that gives a location to processes and files.
- ▶ It **shares CPUs, memory, and disk space** in a fair and efficient manner between competing processes.
- ▶ It allows **processes and peripherals to talk to each other**, even if they're on different machines.
- ▶ It comes complete with **a large number of standard utilities**.
- ▶ There are plenty of high-quality, **commercial software packages** available for most versions.
- ▶ It allows programmers to easily access operating features via **a well-defined set of system calls**, which are analogous to library routines.
- ▶ It is **a portable operating system** and is thus **available on a wide variety of platforms**.



Unix Philosophy

- ▶ **Small is beautiful**
 - Easy to understand
 - Easy to maintain
 - More efficient
 - Better for reuse
- ▶ **Make each program do one thing well**
 - More complex functionality by combining programs
 - Make every program a filter
 - These small utilities should be **combined** to accomplish more complex tasks.
- ▶ **Portability over efficiency**
 - Most efficient implementation is rarely portable
 - Portability better for rapidly changing hardware
- ▶ **Use flat ASCII files**
 - Common, simple file format (XML)
 - Example of portability over efficiency



Unix Philosophy

- ▶ Reusable code

- Good programmers write good code; great programmers borrow good code

- ▶ Silence is golden

- Only report if something is wrong

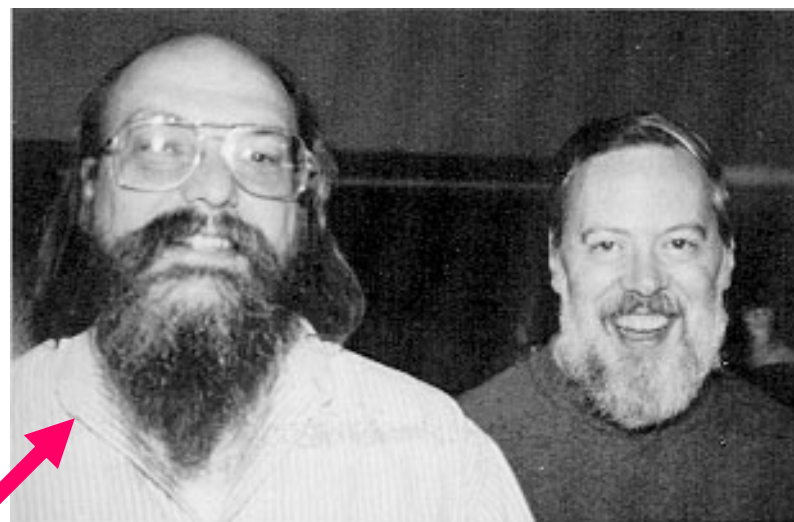
- ▶ Think hierarchically



Unix Yesterday

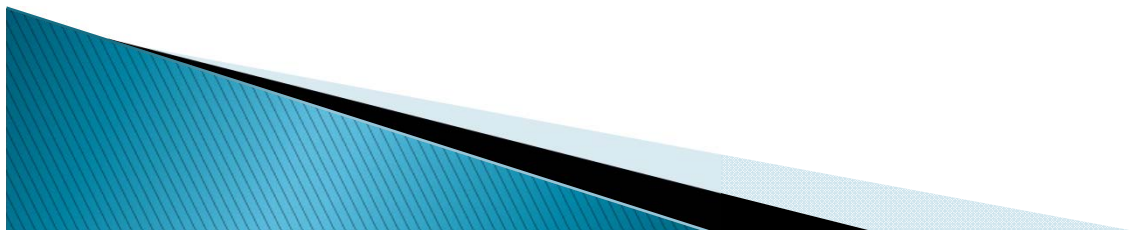


- ▶ 1969
- ▶ A computer scientist named **Ken Thompson** at **Bell Laboratories** built the **first version of UNIX**. It was built to support some gaming needs that could not be met by existing systems.
- ▶ Called UNICS
- ▶ written by using **assembly language**,
- ▶ only **a single-user system**,
- ▶ **no network capability**,
- ▶ **poor memory-management system** for sharing memory between processes.
- ▶ In spite of the shortcomings,
--> **efficient, compact, and fast**, which was exactly what he wanted.



Unix Yesterday

- ▶ A few years later, a colleague of Ken's, **Dennis Ritchie**, suggested that they rewrite UNIX using the C language.
- ▶ the UNIX system suddenly had a huge advantage over other operating systems
 - its source code was understandable.
- ▶ Only a small percentage of the original source code remained in assembly language, which meant the porting the operating system to a different machine was quite easy.
- ▶ AT&T, Bell Labs' parent company, was not allowed to enter computer business, so Unix was not commercialized originally.



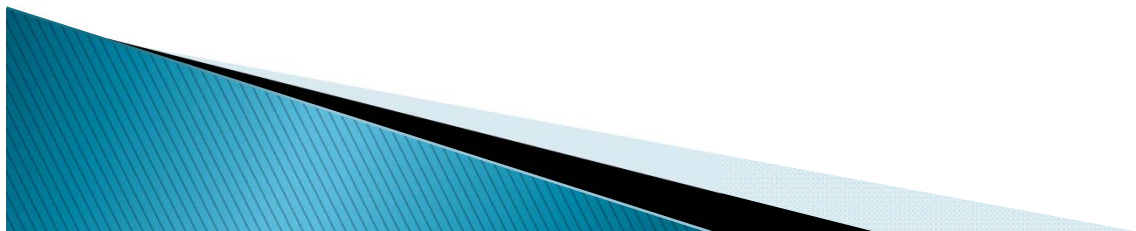
Unix Yesterday

- ▶ Received National Medal of Technology in 1999



Unix Yesterday

- ▶ 1970
 - Called UNIX
 - Text Processing runoff
- ▶ 1972 – 10 machines running Unix
- ▶ 1973 – OS rewritten in C



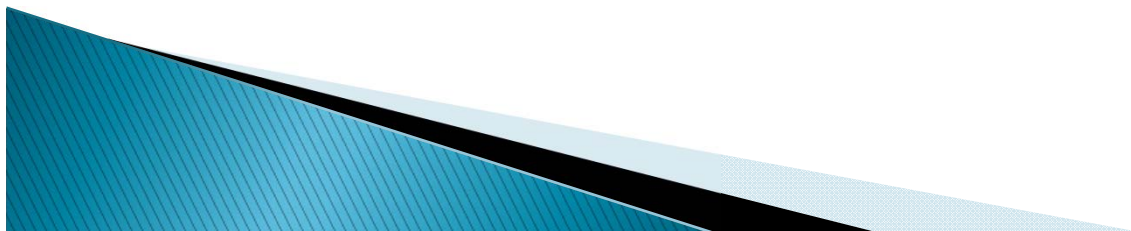
Unix Yesterday

- ▶ From 1975 to 1979
- ▶ **Bell Laboratories** allowed universities to obtain a free copy of the UNIX source code.
- ▶ The University of California at Berkeley, made **some huge improvements** over the years, including **the first good memory-management system** and **the first real networking capability**.
- ▶ UC Berkeley offered a version of UNIX, called **BSD (Berkeley Standard Distribution)** to the general public.



Unix Yesterday

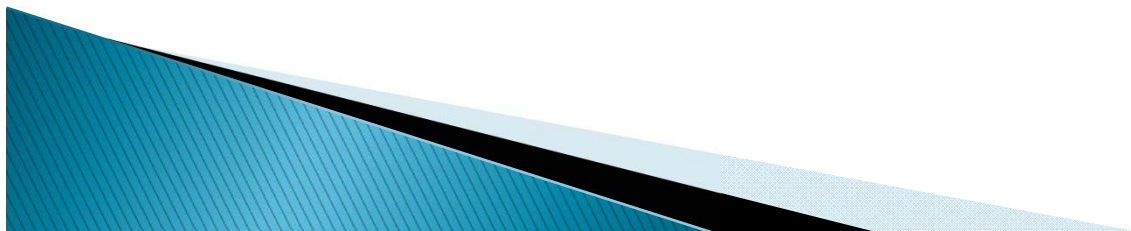
- ▶ 1977 – 600 systems
- ▶ 1982 – Became commercial
- ▶ **Primary Versions**
 - U of C at Berkeley
 - BSD
 - AT&T / Unix Systems
 - System V



Unix Yesterday

► Variations

- UNIXWARE
- Solaris
- SCO UNIX
- IRIX
- HP-UX
- DEC-OSF/1
- AIX
- LINUX
- A/UX



Unix Yesterday

▶ Side Note – 1980

- MS tried to sell Unix before DOS
 - Xenix – 1980
- Worked on a 8086

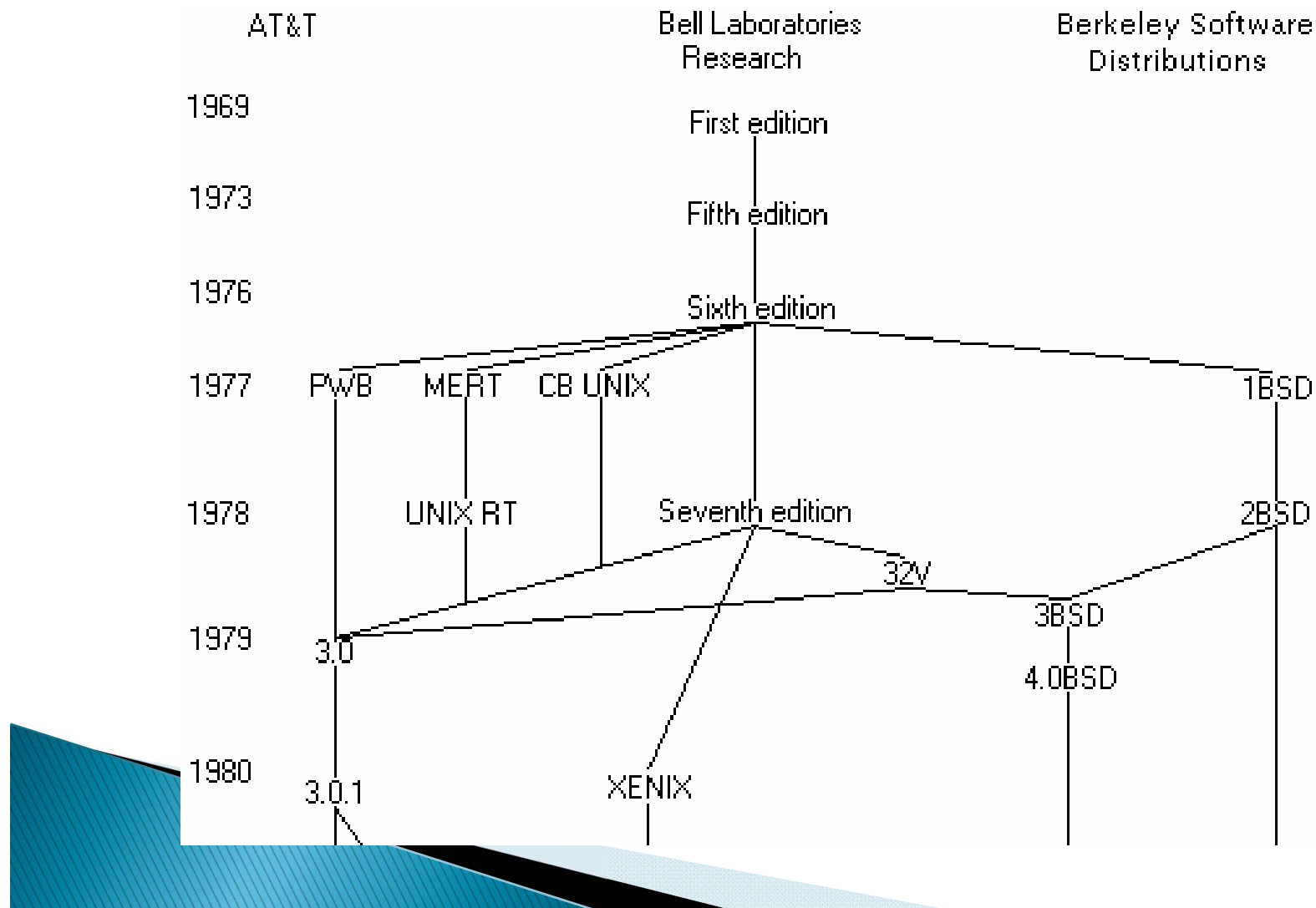
▶ Microsoft Announces XENIX

- Microsoft announces Microsoft XENIX OS, a portable operating system for 16-bit microprocessors. It is an interactive, multi-user, multi-tasking system that will run on Intel 8086, and DEC PDP-11 series. All of Microsoft's existing system software (COBOL, PASCAL, BASIC and DBMS) will be adapted to run under the XENIX system, and all existing software written for UNIX OS will be compatible as well.

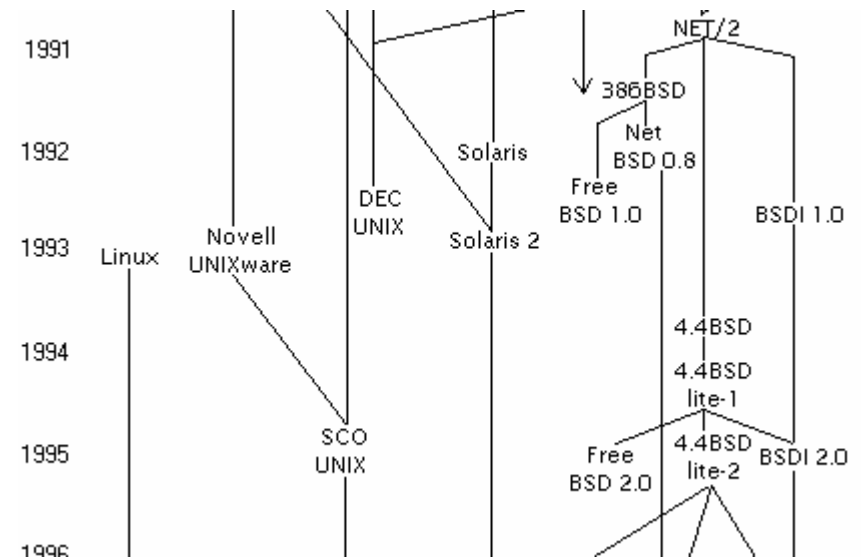
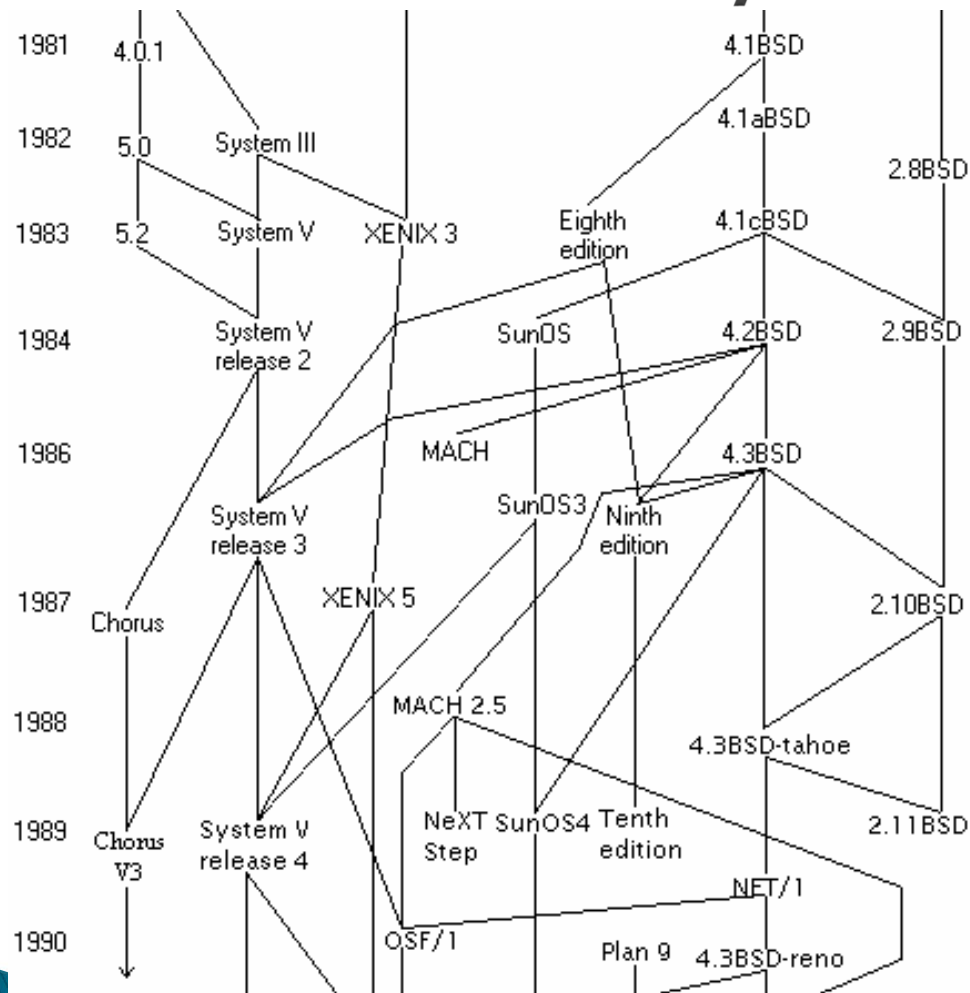
▶ Gave up on it... sold to SCO



Unix Yesterday



Unix Yesterday



Unix Yesterday

▶ The Grand Unification

- AT&T combined
 - Xenix, BSD, SunOS
- Created System V SVR 4
- Written Standards
- Other companies developed POSIX
 - Portable OS Interface
 - Based on System V



Unix Yesterday

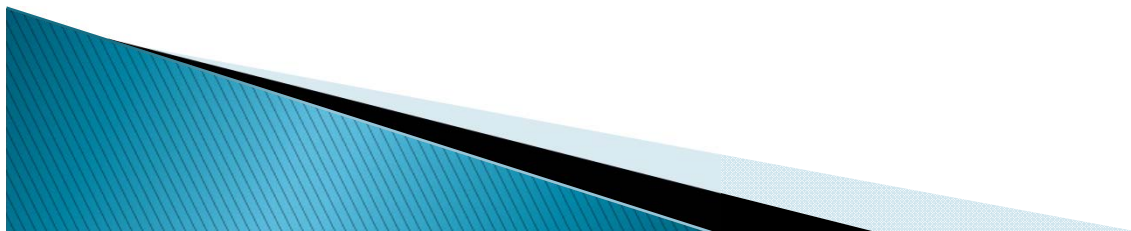
▶ UNIX System V Release 4

- Unified command set
- Shells, User Interfaces
- Directory Tree
- I/O and System Access
- Real-Time Processing
- System Administration
- Networking
- Internationalization
- Application Development
- File Systems and Operations
- Memory Management



Unix Today

- ▶ A more recent entry into the UNIX world is [Linux](#), a free version of UNIX written by [a student in Finland](#) and now marketed and supported by several different companies.



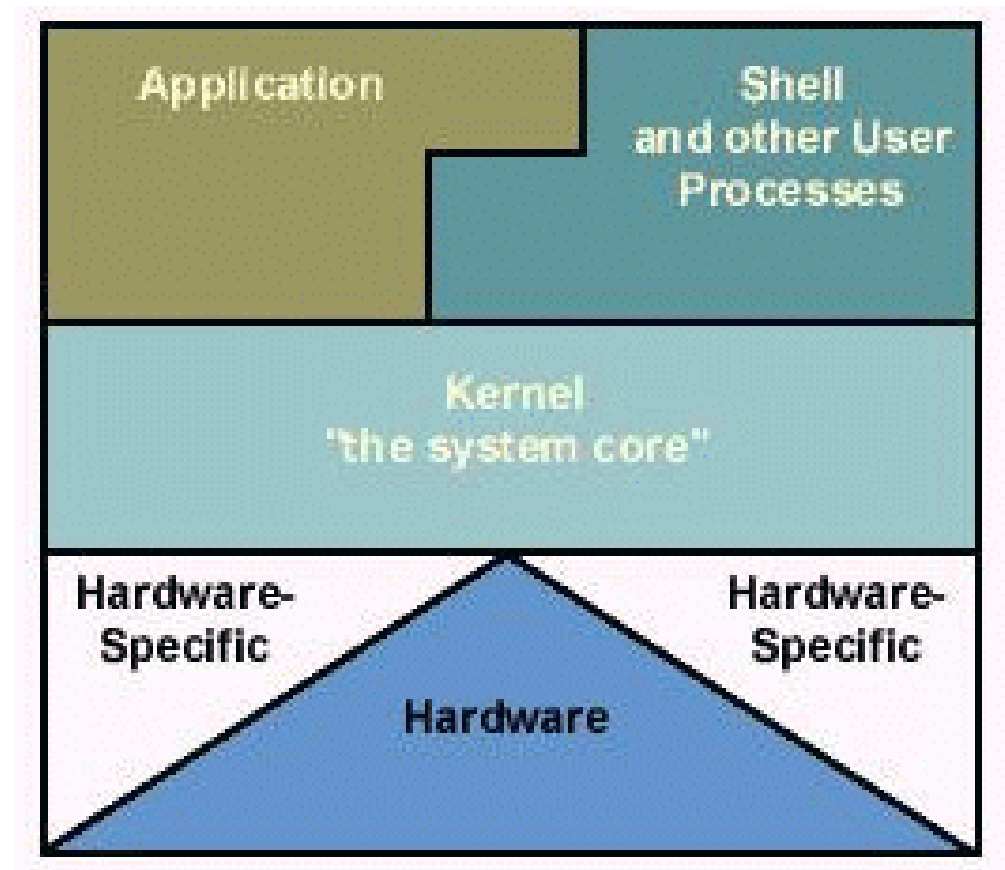
Why is UNIX Important?

- ▶ Open Source Code
- ▶ Cooperative Tools and Utilities
- ▶ Multi-User/Multi-Tasking
- ▶ Excellent Networking
- ▶ Portability



Why is UNIX Important?

- ▶ Applications
- ▶ Utilities
- ▶ File System
- ▶ Shell
- ▶ Kernel



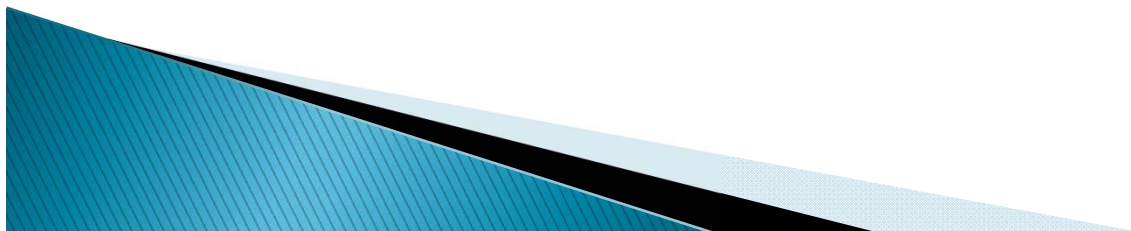
What's a shell?

- ▶ It is the command line interface
- ▶ The three most common are
 - Bourne (\$) The basic shell
 - Korn (\$) An improved Bourne
 - C (%) Syntax similar to C
- ▶ You can use any at any time



Why is Unix popular?

- ▶ OS can handle advanced hardware
 - Easy to scale up
- ▶ Open system – not proprietary
- ▶ Written in HLL – C
- ▶ Source code is available
- ▶ Designed to be multiuser
- ▶ Cross Platform Standard



Linux

- ▶ Free Software Foundation
- ▶ GNU – Gnu's Not Unix
- ▶ Richard Stallman
- ▶ Created
 - Copyleft
 - GPL
 - EMACS



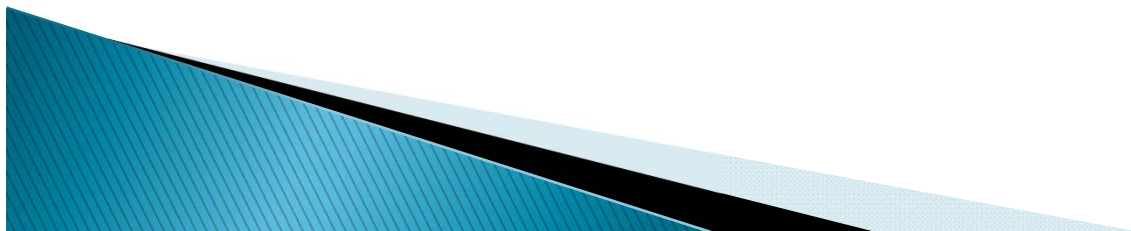
Linux

- ▶ Linus Torvalds
- ▶ 1994 – 1.0
- ▶ 1995 – 1.2
- ▶ 1999 – 2.2



How can UNIX run on so many machines?

- ▶ Developed in C
- ▶ Only a small part in Assembly
- ▶ First written in assembly for PDP-7
- ▶ Later ported to the B language
- ▶ Thompson redefined B to C
- ▶ The whole system is based in C
- ▶ That's why you have to know C



Overview of Unix System

- ▶ Utilities
- ▶ Multiuser
- ▶ Multitasking
- ▶ System Kernel
- ▶ File Structure
- ▶ Security
- ▶ Shells
- ▶ Filename Pattern matching
- ▶ Device Independent I/O
- ▶ Interprocess Communications



More Features

- ▶ Job Control
- ▶ Electronic Mail
- ▶ Screen Oriented Editor – vi
- ▶ Scrolling thru a file
- ▶ Networking Utilities
- ▶ Shell functions
- ▶ Graphical User Interfaces
- ▶ System Administration



What are the limitations of UNIX?

- ▶ Unfriendly, unforgiving
- ▶ "No news if good news"
- ▶ A lot of stuff still done at the command line level.
- ▶ Don't ask why – it just is...

