

UNIX =?= LINUX

Operating Systems

- ❖ An operating system (OS) is a software that manages the computer's resources (hardware) and provides a convenient and safe environment for running programs
- ❖ OS is loaded into computer memory when the computer is booted and remains active as long as the machine is up
- ❖ The three most common computer operating systems
 - ◆ Microsoft Windows
 - ◆ Linux - UNIX-like OS
 - ◆ Mac OS (Unix-based graphical interface OS)

The Origin of UNIX

❖ When:

- ◆ UNIX was “born” in 1969 from the idea of Multics project (**Multiplexed Information and Computing Service**)
 - A cooperative project led by MIT, GE and Bell Labs. Bell withdrew from in 1969
- ◆ System
 - PDP-7 from Bell Lab
 - A *minicomputer* by Digital Equipment Corporation (DEC) in 1965.
 - Cheaper - \$72,000 (PDP-4 was priced \$120,000)

❖ Language

- ◆ In assembly language: PDP-7

❖ Who and How?

- ◆ Ken Thompson (joined by Dennis Ritchie)
 - Ken Thompson lost a system to play his Space Travel game due to the ending of Multics project
 - Thompson wrote his first version of UNIX on PDP-7 so he could continue to play the game
- ◆ Was spelled as UNICS as “*treacherous pun*” on Multics

PDP-7



- Word length: 18 bits
- RAM: 144 KB (considered substantial at that time)
- Input and output was conducted via a [teletypewriter \(TTY\)](#)
- Ultimately, 120 of the systems were produced and sold.

- ❖ In 1973, Thompson and Ritchie rewrote Unix in C language on PDP-11 (16-bit system, \$65,000), V4
- ❖ ACM paper in 1974
 - ◆ *The UNIX Time Share System* by Dennis M. Ritchie, Ken Thompson , Communication of the ACM, Vol. 17, No. 7, 1974.
 - ◆ UNIX slowly had spread to the research labs and universities all over the world
- ❖ UNIX started as open source
 - ◆ AT&T had been forbidden from entering the computer business
 - UNIX could not be turned into a product by AT&T
 - Thompson gave away the tapes/disk to requesters
 - ◆ Many universities contributed to UNIX
 - Berkley, especially when Ken Thompson taught at the University during 1975-1976 sabbatical
 - First BSD release run by Bill Joy, then an unknown student in UC Berkley



Ken Thompson (seated) and Dennis Ritchie (standing) at a PDP-11 in 1972



(Obtained from the Internet) On April 27, 1999, Thompson and Ritchie jointly received the 1998 National Medal of Technology from President Bill Clinton *for co-inventing the UNIX operating system and the C programming language*

UNIX Wars in 1980s

- ❖ Sun Microsystems was founded by Bill Joy in 1982
 - ◆ To build dream UNIX machine with built-in networking capability
- ❖ The broke up of the Bell System in 1983 relieved AT&T from the 1958 consent decree which prevented them from turning UNIX into a product.
- ❖ AT&T promptly rushed to commercialize UNIX System V
 - ◆ 1980, SVR1 (System V Release 1) released commercial version, combined with different versions of UNIX at that time
- ❖ AT&T clamped down hard on source-code distribution
 - ◆ Pricy license: \$40,000
 - ◆ Contributions from universities began to dry up, no individual could afford the source-code license
- ❖ Two main distributions of UNIX systems
 - ◆ 1980s, UC Berkeley researchers continued to develop BSD UNIX as an alternative to the AT&T UNIX system, later became the other major UNIX distribution, BSD (Berkeley Software Distribution)
 - BSD 4.2 in 1983 with TCP/IP implementation
 - ◆ 1988, AT&T consolidated all the versions of UNIX into SVR4

*In 1981, Microsoft made its historic deal with IBM over the new IBM PC. **Bill Gates** bought **QDOS** (Quick and Dirty Operating System), a clone of CP/M that its programmer Tim Paterson had thrown together in six weeks, from Paterson's employer Seattle Computer Products (SCP). Gates, concealing the IBM deal from Paterson and SCP, bought the rights for **\$50,000**. He then talked IBM into allowing Microsoft to market **MS-DOS** separately from the PC hardware. Over the next decade, leveraging code he didn't write made Bill Gates a multibillionaire, and business tactics even sharper than the original deal gained Microsoft a monopoly lock on desktop computing.*

- "The Art of Unix Programming" by Eric Steven Raymond

Note*

QDOS contained about 4,000 lines of assembler language code

GNU Project



- ❖ Free Software Foundation (FSF, 1983)
 - ◆ Founded by [Richard Stallman](#) of MIT
 - ◆ The principal organization sponsor of GNU Project: <http://www.gnu.org>
- ❖ Launched in 1984
- ❖ To develop a complete UNIX-like operating system
- ❖ Open source, free software
 - ◆ Free to run the program; Free to copy the program and give it away to anyone; Free to change the program as your wish; Free to distribute an improved version

GNU/Linux

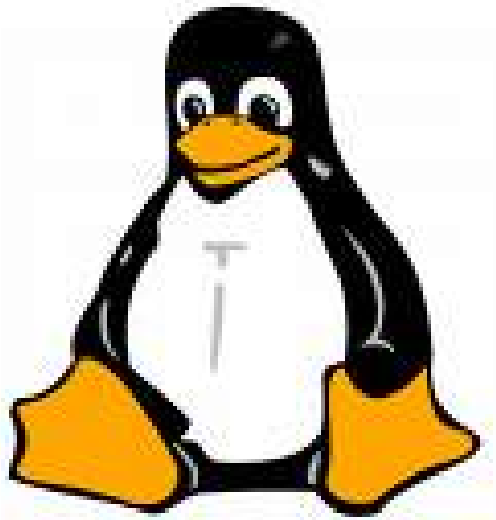
- ❖ Linux is a free UNIX-like OS for x86 system
 - ◆ Linux kernel was created in 1991 by [Linus Torvalds](#), then a college student in Finland
 - ◆ Torvalds and other early Linux kernel developers adapted their work for the GNU tools to create a complete, fully functional, and free operating system
 - ◆ By late 1993, Linux had both Internet capability and X
- ❖ Up-to-date
 - ◆ Torvalds continues to direct the development of the kernel
 - ◆ Other subsystems continue to be developed separately, glibc, gcc, etc.
- ❖ Linux kernel is not part of the GNU Project



Linus Torvalds

Linux Logo

Linux logo (mascot): why penguin? Linus Torvalds' email explained:



“... when you think about penguins, first take a deep calming breath, and then think “cuddly”. Take another breath, and think “cute”. Go back to “cuddly” for a while (and go on breathing), then think “contented ...”

...

“... so we should be thinking of a lovable, cuddly, stuffed penguin sitting down after having gorged itself on herring...”

<http://www.linuxscrew.com/2007/11/14/why-penguin-is-linux-logo/>

Linux Distributions

- ❖ A GNU/Linux operating system is made of
 - ◆ a Linux kernel,
 - ◆ a set of GNU tools,
 - ◆ an installation program,
 - ◆ a package management system and
 - ◆ a lot of other software components.
- ❖ Because all the above components are free to use and to distribute, anybody can assemble and configure them according to their needs and create their very own GNU/Linux operating systems
- ❖ The website <http://www.distrowatch.com> lists more than 350 active distributions and reports new releases almost every day
 - ◆ **Ubuntu**: first emerged in 2004, now became the most used for desktop
 - ◆ **openSUSE**
 - ◆ **Fedora**, formerly by Red Hat, now CentOS
 - ◆ **Debian**, created in 1993 founded by Ian and his then-girl friend Debra
 - ◆ **Gentoo**: source distribution

Linux Distributions



Summary

- ❖ Historically, two major UNIX distributions
 - ◆ AT&T and BSD
- ❖ Linux is a UNIX-like open source OS
 - ◆ (Linux Is Not Unix)
- ❖ MacOS is BSD Unix based