

First course of Computer Science

Part VI: Operating System - history



Goals of this part

- Know the evolution of Oss
 - Understand the requirements for Oss
 - Provide friendly interface for users
 - Manage the resources for the multitasked/**multi-programmed** programs/**processes**
- Know the categories of Oss
 - Batch OS
 - Time-sharing OS
 - PC OS
 - ...

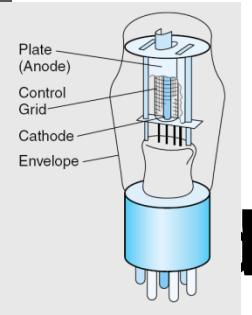
- Evolution of Operating System
 - From simplicity to Complexity
 - Multiprogramming is the fundamental concept
 - Trend of providing friendly interface
- Selected Oss
 - Mac OS
 - Windows

We have learned ...

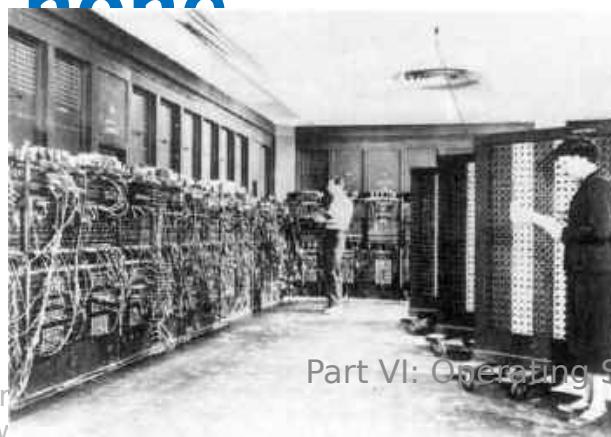
- Concurrent Multiprogramming [并发的多道程序运行]
 - Also means the number of programs is more than one
 - How to arrange the programs so that interfering each other is less?
 - Once the CPU is idle, how to select a program to be elected to get the authority to use the CPU?
 - How to guarantee that the switching among the running programs turns all the results are correct?
 - If the devices are not enough to be shared by those stored programs, how to avoid the bad arrangement
 - Such as **deadlock**
 - ...

We really
need some
mechanism to
manage this
complex
situation!

First generation 1945 - 1955



- Technology: **vacuum tubes & plug-s**
- Programming: **setting some switches**
- Programming language: **machine language**
- Tasks: **tables of sine, cosine, logarithms**
- OS: **none**



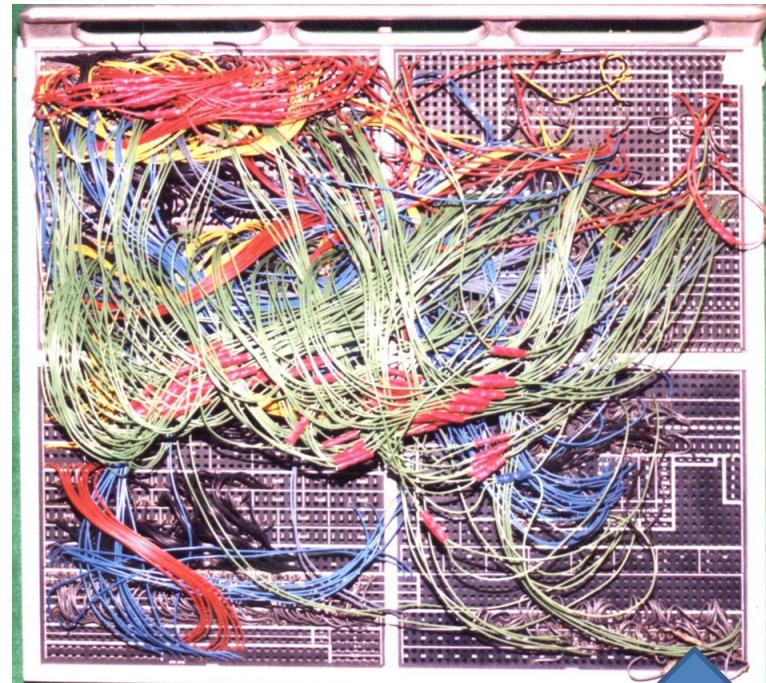
Part VI: Operating System - history

History of Operating Systems

(1)

• Computer designer is:

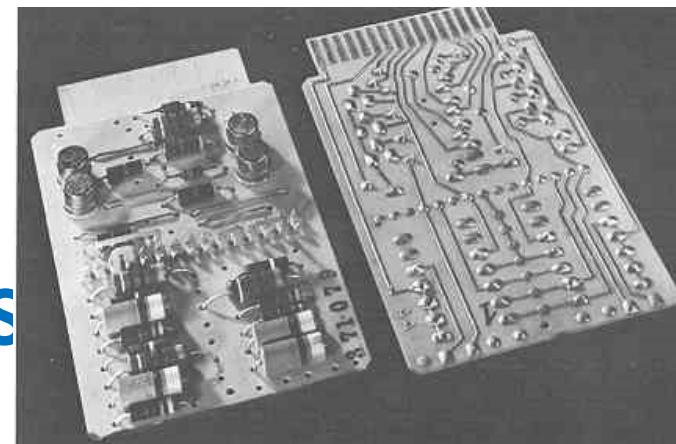
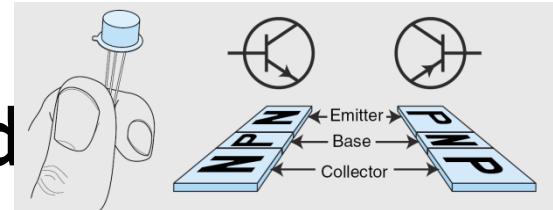
- builder and
- programmer and
- operator and
- “sys admin”



Programming in those days

Second generation 1955 – 1965

- Technology: **Transistors**
- Programming: **Punched card**
- Programming languages: **FORTRAN & Assembly**
- Tasks: **Scientific**
- Computer: **Mainframes**
- OS: **Simple Batch system (S)
[Offline or Online]**



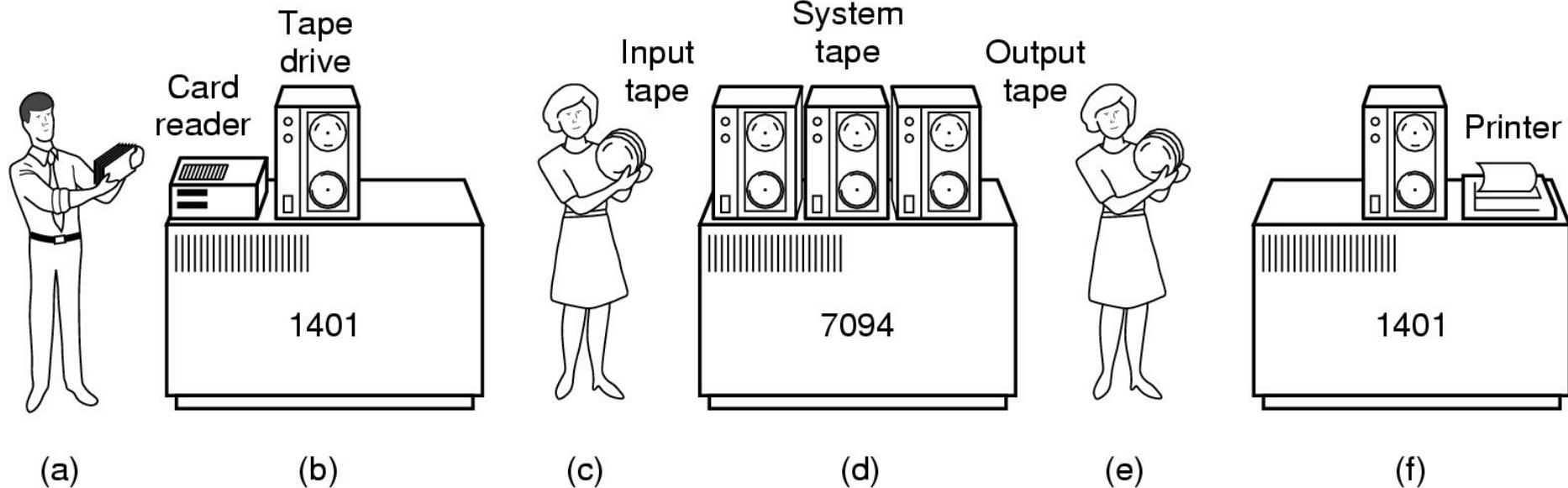


<http://grainedit.com/2008/03/04/clarence-lee-ibm-poster/>

- During that period, the symbol of computers is IBM's mainframe – IBM 7094



Early offline Simple Batch System (SBS)



- bring cards to IBM 1401 machine (**good at card reading**)
- read cards to tape
- put tape on IBM 7094 which does **computing**
- put tape on IBM 1401 which **prints output offline**

IBM 7094 and its OS – FMS

- The 7090 and 7094 were operated in **batch mode**, controlled by the **Fortran Monitor System (FMS)**.
 - Batch jobs on cards were transferred to tape on an auxiliary 1401, and the monitor took one job at a time off the input tape, ran it, and captured the output on another tape for printing and punching by the 1401.
 - Each user job was loaded into core by the BSS loader (**Binary Symbolic Segment loader**) along with a small monitor routine that terminated jobs that ran over their time estimates.
 - Thus, each user's job had complete control of the whole 7094, all 32K words of memory, all the data channels, everything.

- And IBM was smart then
 - It donated IBM 7094 to UM (Univ. of Michigan) and MIT
 - IBM's managers required UM and MIT to stop their computing jobs on 7094 to finish match computing, because those managers liked sailing most



Match racing - Open - Wednesday 18 April 2012

Pos	Name	Country	Crew	Events	Previous	Best	Points
1	Williams Ian	GBR		8	1	1	12074
2	Mirsky Torvar	AUS		8	3	1	11065
3	Bruni Francesco	ITA		8	2	1	10904
4	Morvan Pierre-antoine	FRA		8	4	4	10770
5	Hansen Bjorn	SWE		8	5	4	10667
6	Radich Jesper	DEN		8	6	1	10479
7	Swinton Keith	AUS		8	13	7	9866
8	Berntsson Johnie	SWE		8	7	7	9792
9	Robertson Philip	NZL		8	9	7	9757
10	Gilmour Peter	AUS		8	10	1	9472

http://en.wikipedia.org/wiki/University_of_Michigan_Executive_System

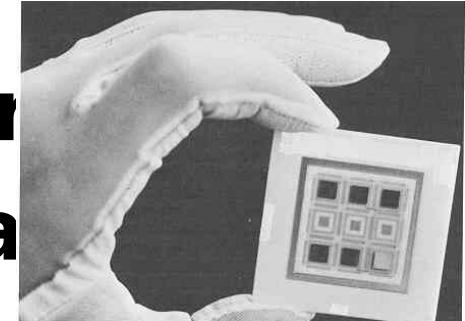
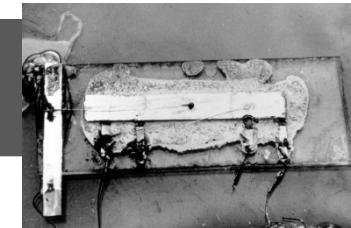
- UM provided UMES (University of Michigan Executive System)
 - To overcome that indignant requirement so that the intermediate result could be stored!
 - It's a more complex batch operating system developed at the University of Michigan in **1958**, was widely used at many universities.
 - It was in use at the University of Michigan until 1967

IBM 7090/94 and IBSYS (1960)

- IBSYS was the tape based operating system that IBM supplied with its IBM 7090 and IBM 7094 computers.
 - IBSYS was based on FORTRAN Monitor System (FMS) and SHARE Operating System.
 - IBSYS itself was really a basic monitor program
 - read control card images placed between the decks of program and data cards of individual jobs.

- FMS, UMES and IBSYS belong to so-called simple batch (process) system [单道批处理系统]
 - Two sub-types: offline and online
 - No matter which subtype, SBS can only store one job/program in computer's main memory
 - All the resources are occupied by that job which is now in main memory!
 - This is a kind of waste: if there are many IO operations in that job, the CPU is idle!!
- Multi-programmed batch (process) system [多道批处理系统] and Time-sharing system

Third generation 1965 – 1980



- Technology: **Integrated circuit**
- Programming: **Punched card**
- Programming languages: **FORTRAN & Assembly**
- Tasks: **Scientific & commercial**
- Computers: **IBM 360 (大型机), DEC PDPs (小型机)**
- OS:

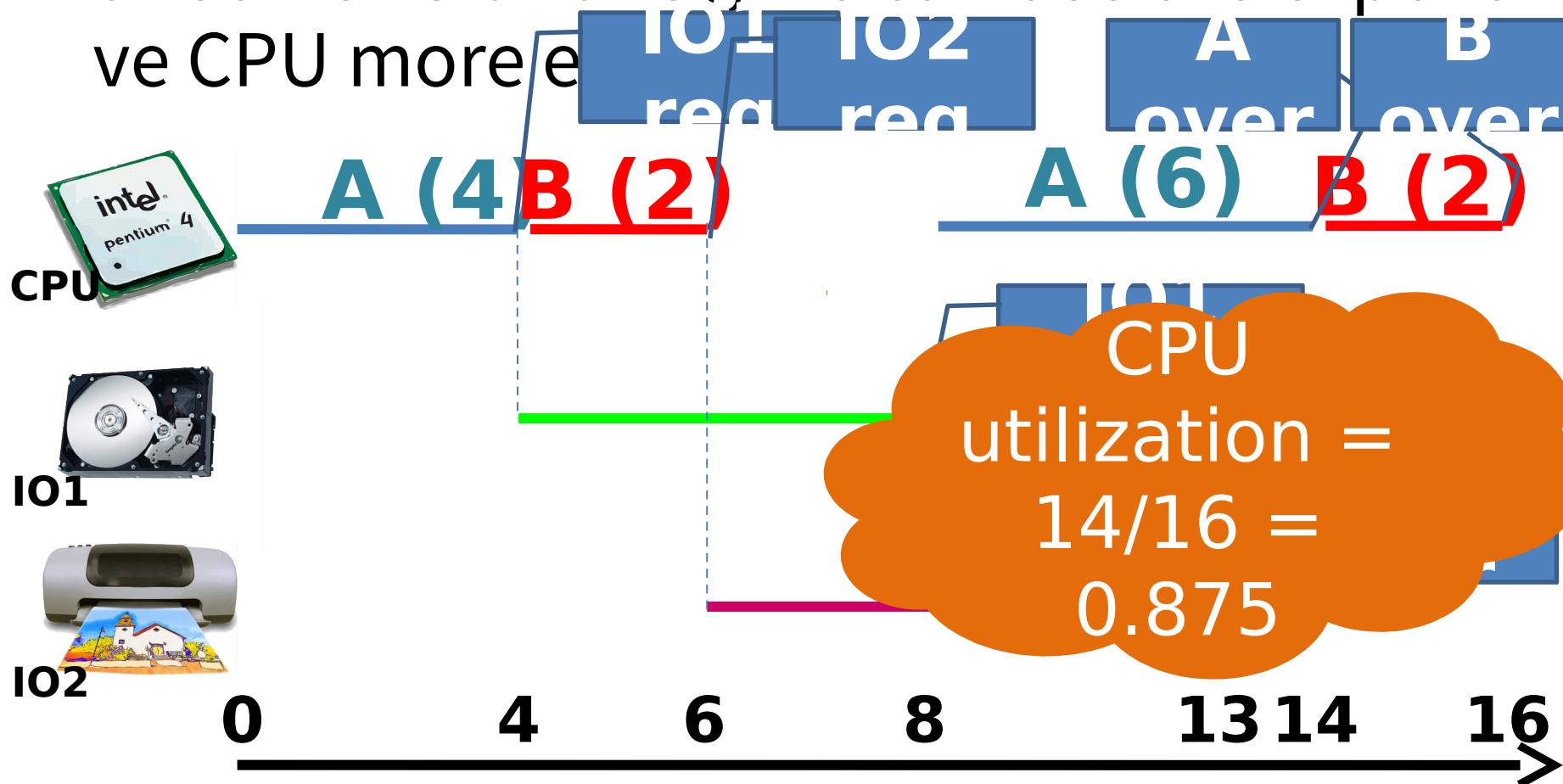
Multiprogramming/timesharing

01. Operating system (PPTs) 2011 (PPTs from
others) www.csee.usf.edu/~anda/www.csee.usf.edu/~anda_cop4600_lectures/lec01.ppt

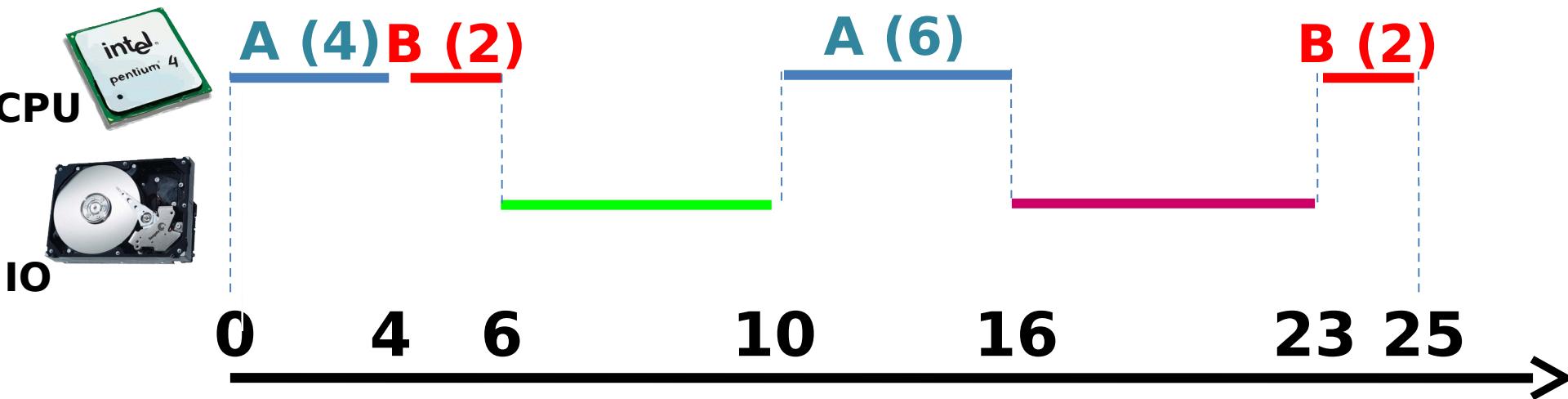
Part VI: Operating System - history

- **Multi-programmed** systems
 - Multi-programmed batch system and Time-sharing system
- To overcome the waste of SBS, we need some kind of multiplexing technique for main memory and parallelism between CPU and IO devices
 - Data channels, Interrupts: overlap I/O and compute
 - DMA – Direct Memory Access for I/O devices
 - I/O can be completed asynchronously
 - Multiprogramming: several programs run simultaneously
 - Small jobs not delayed by large jobs
 - More overlap between I/O and CPU
 - Need memory protection between programs and/or OS

- By multi-programming and parallelism (between CPU and IO), we can use the expensive CPU more effectively



- Without multi-programming



CPU
utilization =
 $14/25 =$
0.56

- CTSS at MIT (1961)

- The "Compatible" in the name refers to compatibility with the standard batch processing OS for the IBM 7094, the FORTRAN Monitor System (FMS)

- CTSS ran an unaltered copy of FMS, processing a standard batch stream, in a pseudo-virtual 7094 provided by its background facility.

- Background FMS jobs could access tapes normally, but could not interfere with foreground time-sharing processes or the resources used to support them.

- CTSS used a modified IBM 7094 mainframe computer that supports two 32,768 36-bit word banks of core memory, up to 112 teleprinter terminals, two custom high speed vector graphics displays, IBM 729 tape drives and an IBM 1301 disk storage (later upgraded to an IBM 1302, with 38 million word capacity)

1962: MULTICS @ MIT

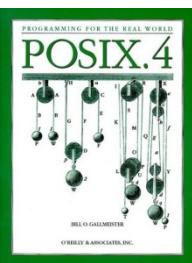
PPTs.2010\Part II Evolution of OS - Add.ppt

- Ambitious project!
 - MULTplexed Information and Computing Service
- Goals of MULTICS
 - Provide service for all users in Boston city
 - Many terminals connected into (time-sharing) games through phone lines
 - Support computing and ~~time sharing~~
 - Reliable huge file systems
 - Store data for so many users
 - Information sharing among users
 - Etc.

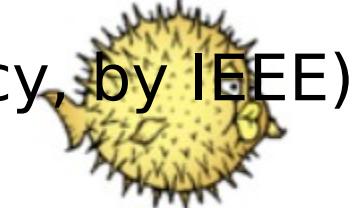
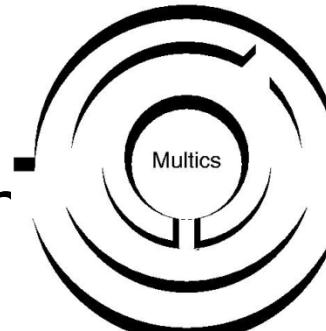
Regretfully,
MULTICS was
not
implemented

- Many properties of modern OSs were first proposed in MULTICS!
 - **Segmentation** (key technique for virtual memory later) was proposed
 - 18 bits segment address and 16 bits offset
 - **Multi-level tree structure for file system**
 - Users can construct their own sub-directories
 - Could **protect users' files**
 - Execution of each program (process later) was safe
 - **Support multi-processor system**

- **Multiprogramming/timesharing**
- OSes Developers
 - CTSS
 - MULTICS (father of all modern OSes)
 - **UNIX** (System V, BSD...)
 - **POSIX** (Not an OS. for concurrency, by IEEE)
 - OpenBSD
 - MINIX (by Tanenbaum)
 - **Linux**



<http://www.minix3.org> (originated by Linus Torvalds, inspired by



OpenBSD



UNIX 1969



- AT&T Bell Laboratories programmers **Kenneth Thompson** and **Dennis Ritchie** developed the **UNIX** operating system on a spare DEC minicomputer.
- UNIX combined many of the timesharing and file management features offered by **Multics**, from which it took its name.
 - (Multics, a project of the mid-1960s, represented the first effort at creating a **multi-user, multi-tasking operating system**.)
- The UNIX operating system quickly secured a wide following, particularly among engineers and scientists.



Dennis Ritchie



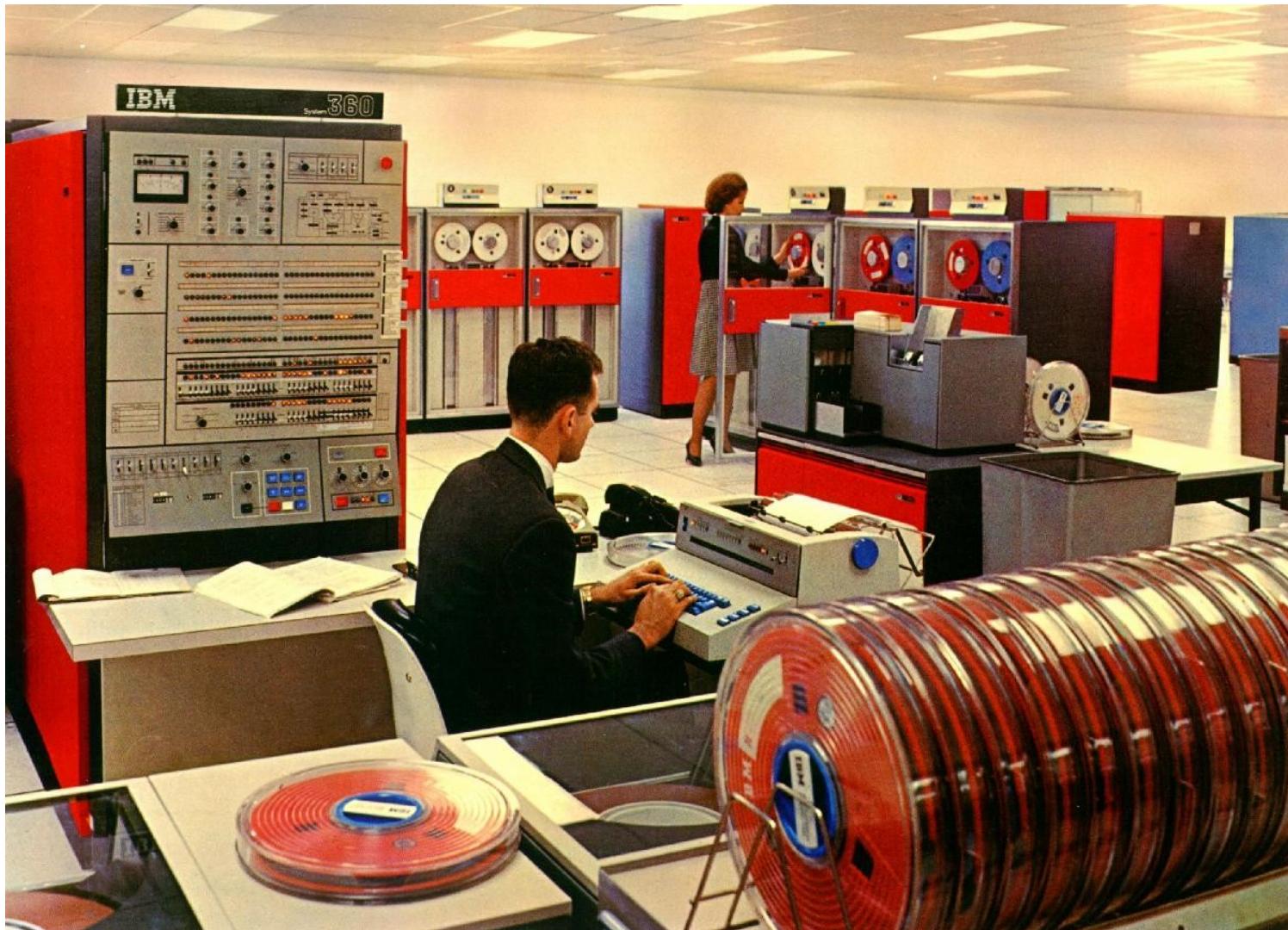
Ken Thompson

<http://www.techcn.com.cn/index.php?doc-view-130701.html>

They are also the cofounders of the HPL C, and the book they wrote about C programming is one of the most popular textbook

IBM 360

The whole system - mainframe (IBM360), input/output machine, and tape machine etc.



IBM 360 and its OS – OS/360

- The operating system planned for the System/360 was 'Operating System/360', or OS/360.
- 4. It was a batch processing operating system.
 - The name 360 was chosen to reflect the fact that it could support a full range of machines. No other operating system existed--PCP
 - PCP (Primary Control Program), a shell which could run only one job at a time, in 1960.
 - MFT (**Multiprogramming** with Fixed number of Tasks) for the mid-range machines
 - MVT (**Multiprogramming** with Variable number of Tasks) for the top end.
- The 360 system was unprecedented [无先例的 ,前所未闻的] in its ability to support a wide array of applications, and it was one of the first operating systems to require direct-access storage devices.

MFT and
MVT were
used until at
least 1981

So-called software engineering is triggered by the development of IBM 360

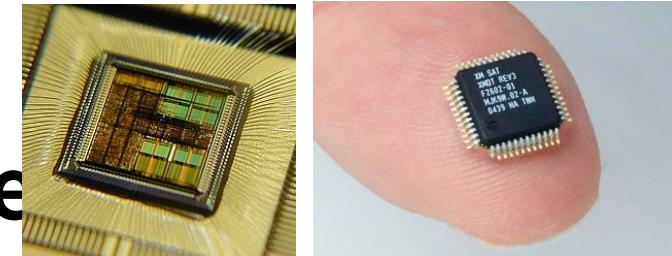
- The development of IBM System/360 is quite complicated
- Frederick P.Brooks, the father of IBM 360, wrote a book
 - “The Mythical Man-Month (人月神话)”
 - Described the development complexity, and triggered the S.E
 - Adopting the engineering idea into the development of complicated software



THE MYTHICAL MAN-MONTH

Fourth generation 1980-Present

- Technology: **VLSI**
- Programming: **High level**
- Programming languages: **C/C++, Java,**
.....
- Computer: **PC, super computers, embedded systems**
- **OS:**
 - **Mainly PC OS:** Windows, Mac OS, Linux ...
 - **But there are many other Oss,** like Parallel
OS, Distributed OS, Embedded OS ...



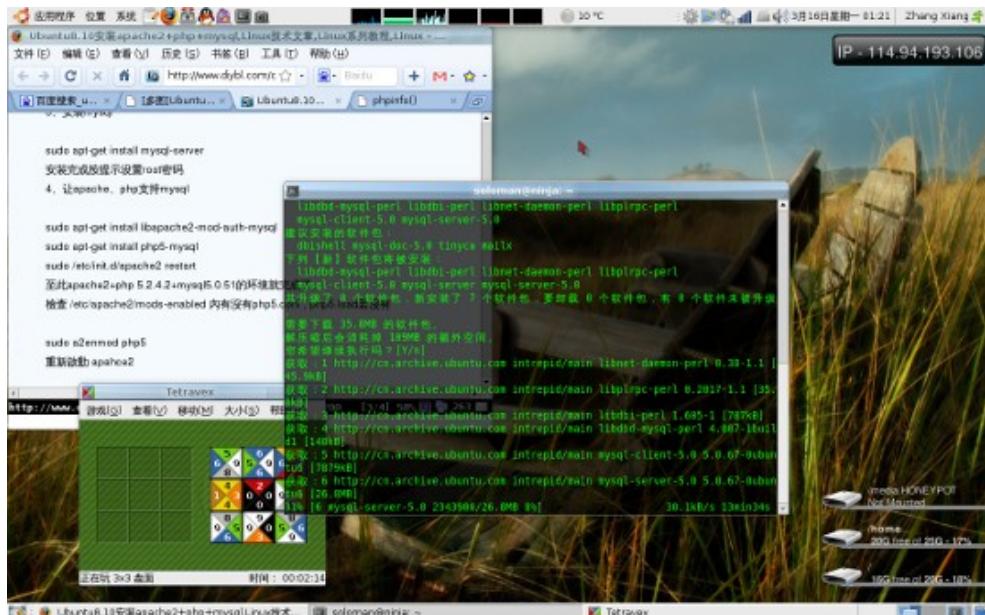
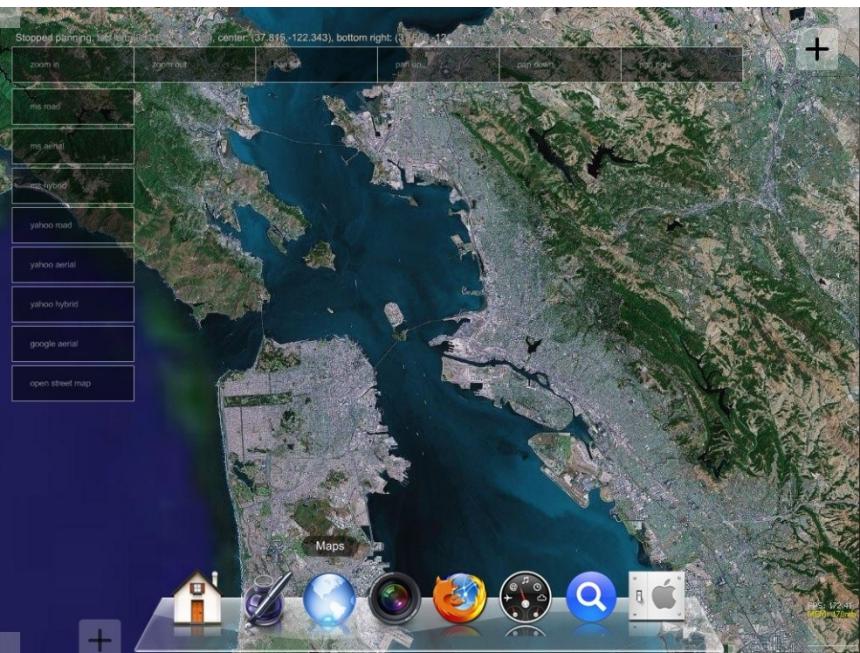
- Hardware: personal computers
- OS design goal: allowing a user to perform many tasks at the same time
 - **Multitasking**: the ability to run multiple programs on the same machine at the same time
 - a single user can run multiple processes
 - **Multiprocessing**: the ability to use multiple processors on the same machine



OS? OS! -GUI Mac os

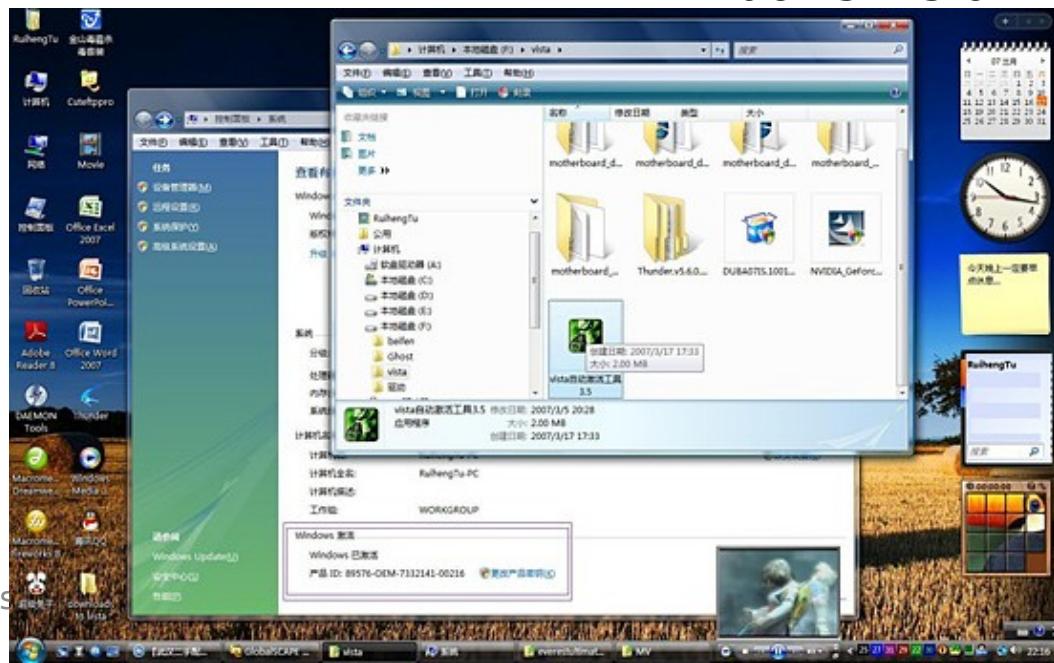


全手触控 Mac OS X 操作系统



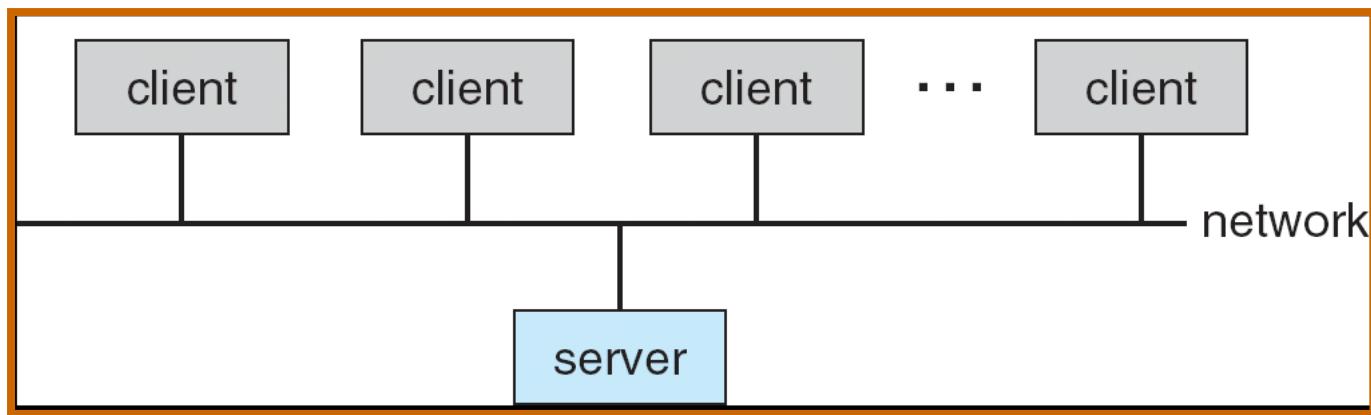
Linux/Ubuntu 8.10

Windows Vista



Distributed Systems (1989—)

- Networking (Local Area Networking)
 - Different machines share resources
 - Printers, File Servers, Web Servers
 - Client – Server Model
- Services
 - Computing
 - File Storage



Mobile Systems (1995—)

- Ubiquitous Mobile Devices
 - Laptops, PDAs, phones
 - Small, portable, and inexpensive
 - Recently twice as many smart phones as PDAs
 - Many computers/person!
 - Limited capabilities (memory, CPU, power, etc⋯⋯)
- Wireless/Wide Area Networking
 - Leveraging the infrastructure
 - Huge distributed pool of resources extend devices
 - Traditional computers split into pieces. Wireless keyboards/mice, CPU distributed, storage remote
- Peer-to-peer systems (**P2P**)
 - Many devices with equal responsibilities work together
 - Components of “Operating System” spread across globe

Evolution of an Operating System

s?

- Must adapt to hardware upgrades and new types of hardware. Examples:
 - Character vs. graphic terminals
 - Introduction of paging hardware
- Must offer new services, e.g., internet support.
- The need to change the OS to place requirements on its design:
 - **modular construction** with clean interfaces.

Some Major Advances in OS Development

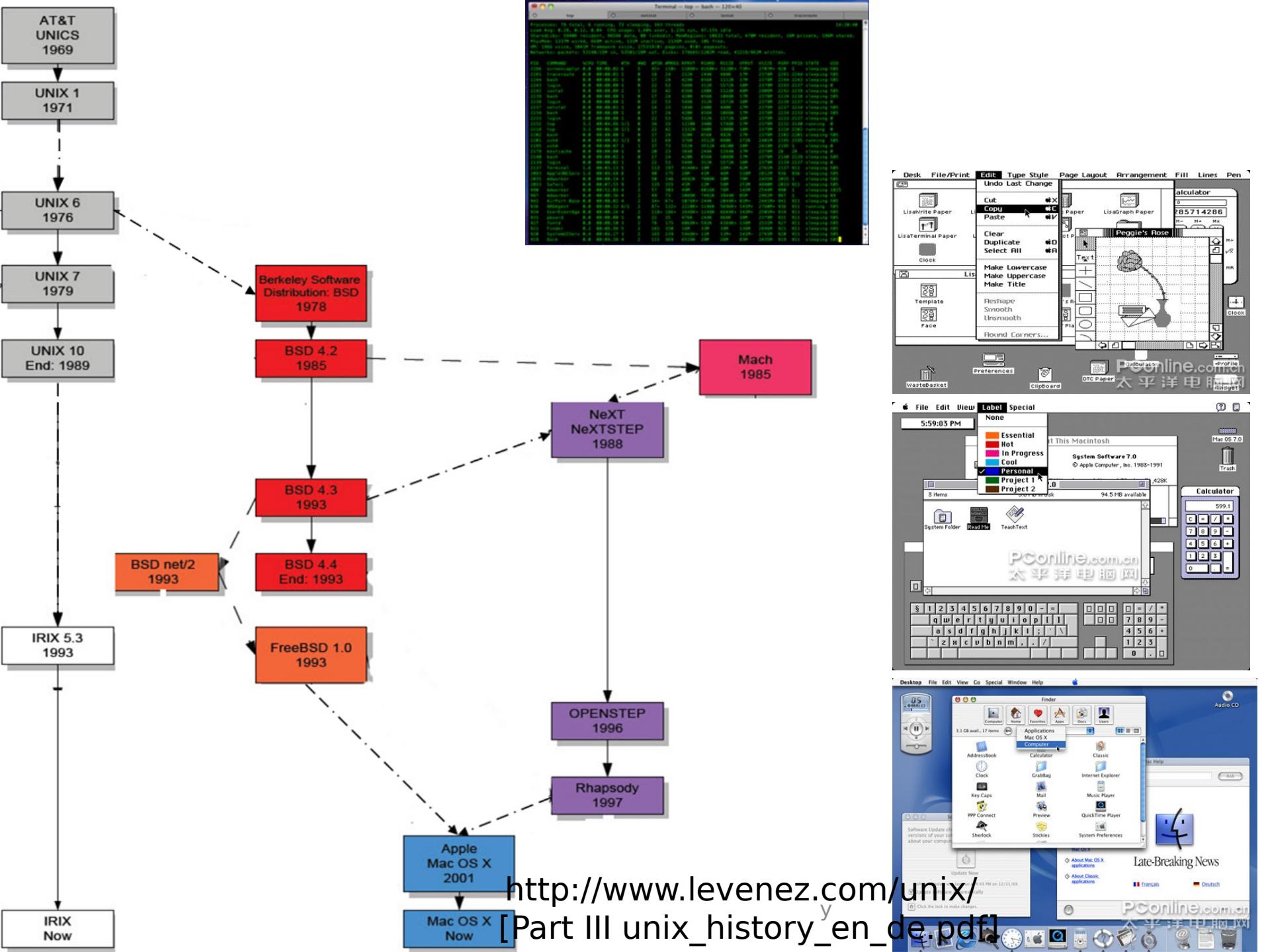
GENERATION	APPROXIMATE DATES	MAJOR ADVANCES
First	1945–1955	No operating system available Programmers operated the machine themselves

- Evolution of Operating System
 - From simplicity to Complexity
 - Multiprogramming is the fundamental concept
 - Trend of providing friendly interface
- Selected Oss
 - Mac OS
 - Windows

Mac OS is based on Unix



Mac OS X Server is built on a fully compliant UNIX foundation. This battle-tested core provides the stability, performance, and security that organizations require. And full UNIX conformance ensures compatibility with existing server and application software. Mac OS X Server is the ideal platform for deploying groundbreaking enterprise applications and services.



Apple I/II



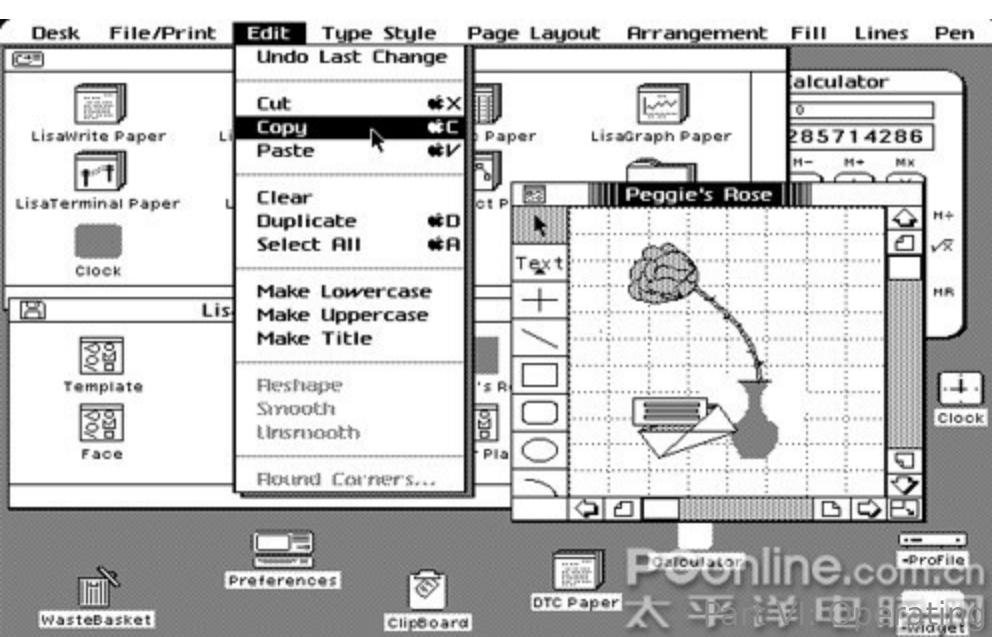
- 1970s, the computer for common users was just a machine -inconvenient to use, even after 30 years of its invention
- Steve Jobs is one of the guys who wanted to change the situation

The first success
of Apple is the

Apple II
computer

**At that time,
the OS used for
Apple I/II was
command line
style, and there
was no mouse
then - all
operations are**

LISA: the first PC of using GUI style



- During his visit in PARC (**Palo Alto Research Center**), Jobs met the Alto computer which was invented by the lab but was just for research - the inventors had not seen its commercial value

- Jobs was astonished by the quite new but friendly style, and decided the style of the OS used for his Lisa - The next PC

- 1983 , LISA - the first GUI PC was proposed, and

Xerox opens **Palo Alto Research Center (PARC)**. In 1970, Xerox Corporation hired Dr. George Pake to lead a new research center in Palo Alto, California. PARC attracted some of the United States' top computer scientists, and produced many groundbreaking inventions that transformed computing—most notably the personal computer graphical user interface, Ethernet, the laser printer, and object-oriented programming. Xerox was unable to market the inventions from PARC but others did, including **Steve Jobs (Apple)**, **Bob Metcalfe (3Com)**, as well as **Charles Geschke and John Warnock (Adobe)**

1970



Photo Courtesy Xerox PARC

Part VI: Operating System - history

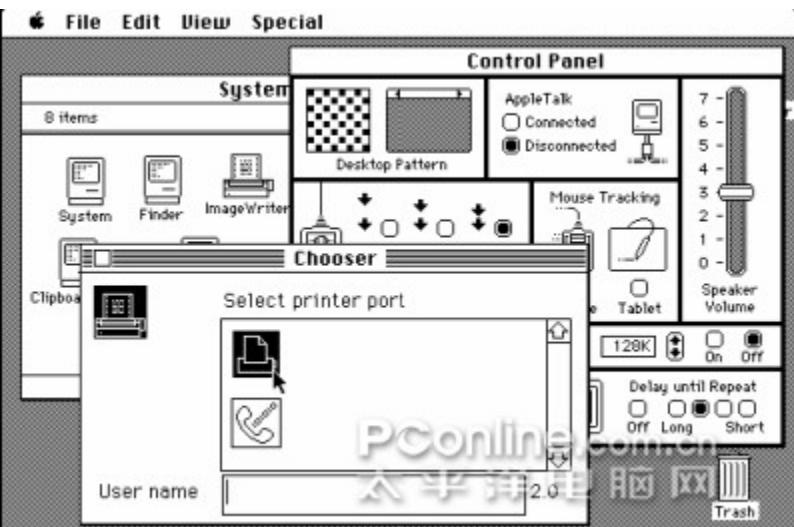
Engineers at PARC circa 1970

Macintosh: the classic PC

macintosh ['mækintɔʃ]
n. 橡皮布，橡皮布防水

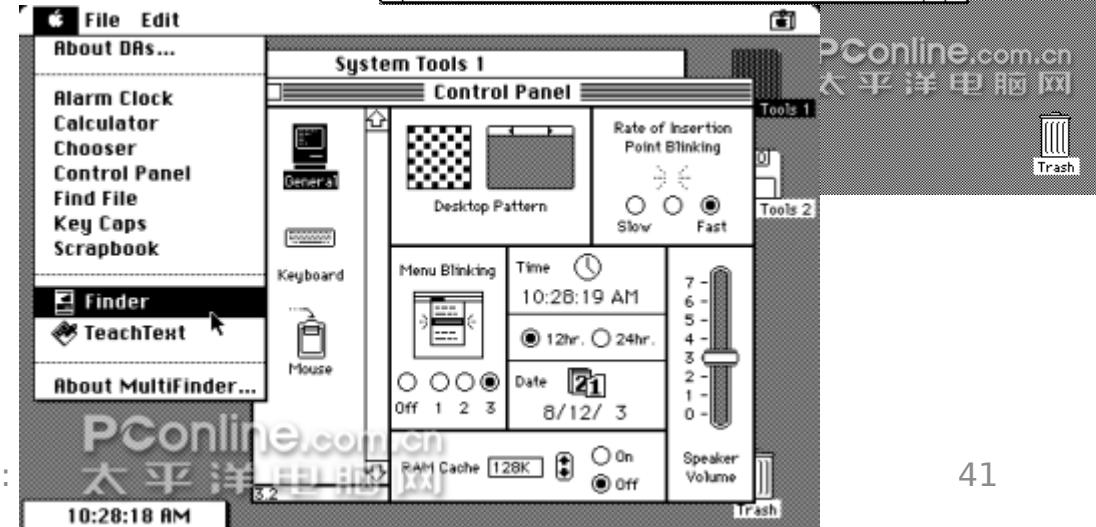


System 3.0

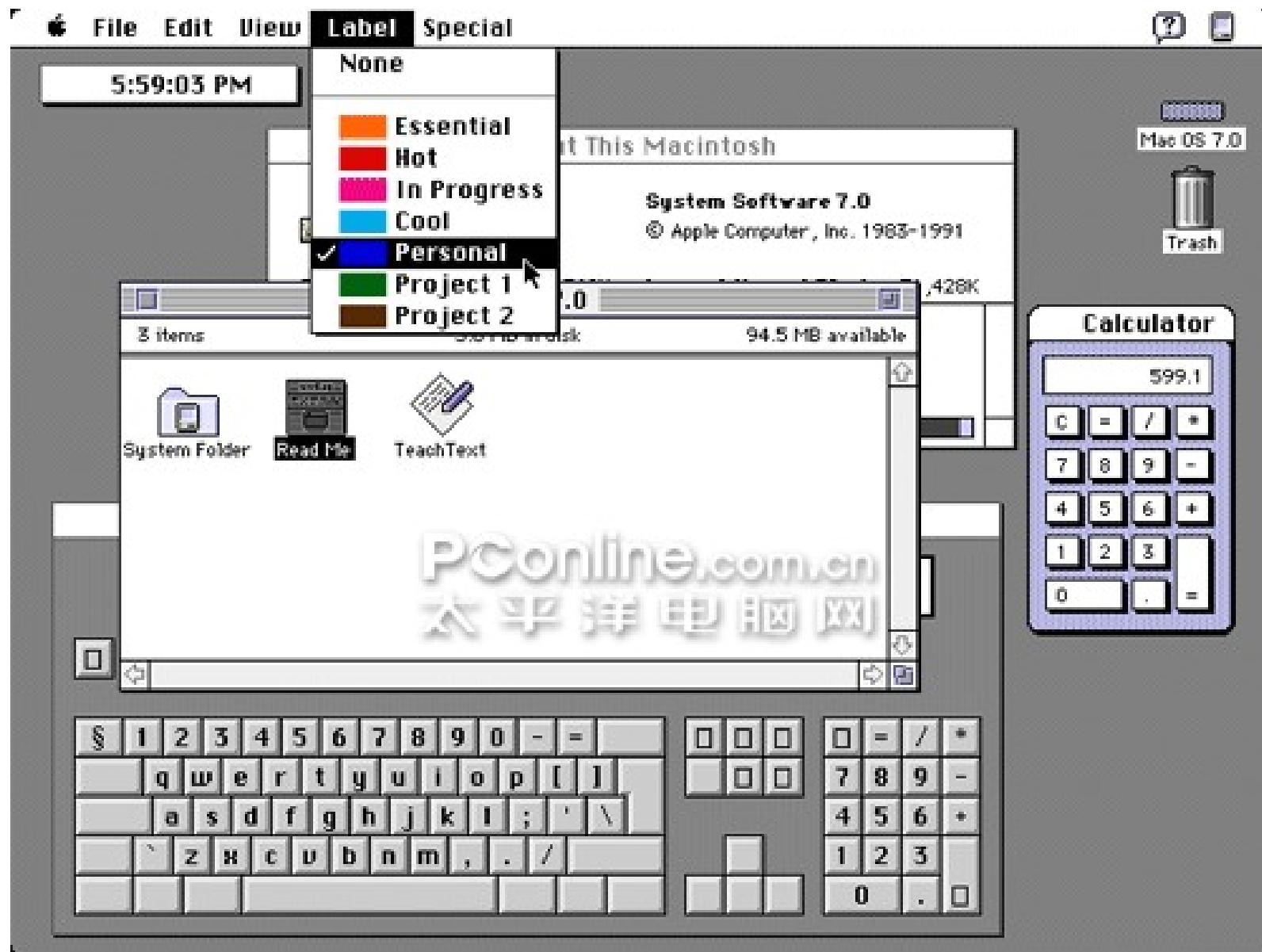


- 1984, the Macintosh began for sale
- The OS used for Macintosh was named System 1.0, which was only black & white
- But most of the elements of the modern GUI OS were used, including desktop, window, scroll bar etc., even

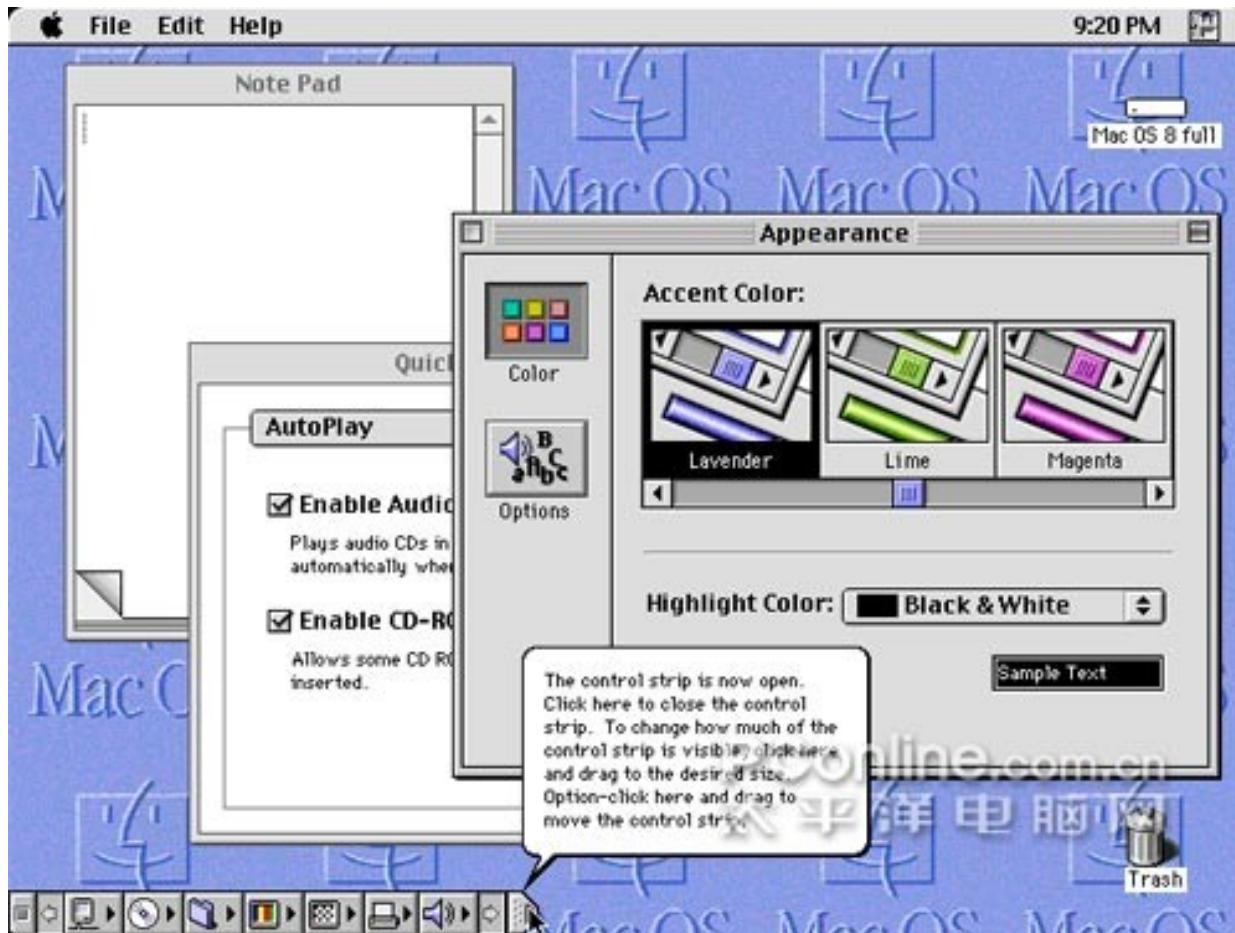
System 4.2



1991 : Mac in color



1997: So called MAC OS begins



- 1997 summer, Apple published the epoch-making [划时代的] OS -- MAC OS 8 (which also terminated the naming rules of System x.x)
- In just two weeks, more than 1,250,000 MAC OS 8 were sold!
- More colorful, supporting network,

MAC OS X (2000) : a product of aestheticism

aestheticism [i:s'θetisizəm] n. 唯美



- Jan 2000 at San Francisco MacWorld, MAC OS X was first proposed
- MAC OS X adopted a new kernel - Darwin, which is a variation of UNIX, and is quite stable
- The most attractive characteristic of MAC OS X is the so-called **Aqua** GUI interface, which is still the peak of the user interfaces

2004: MAC OS X 10.3 Panther[黑豹]



- 2004, MAC OS X 10.3 Panther (黑豹) was proposed, which adopted an important update, and is usually believed as the most interesting update

- Update includes many new properties, such as quick user switch, iChat AV , and the new HI.

Mac OS X 10.6 (2009) : the Snow Leopard

http://pcedu.pconline.com.cn/softnews/cs/0908/1773467_2.html

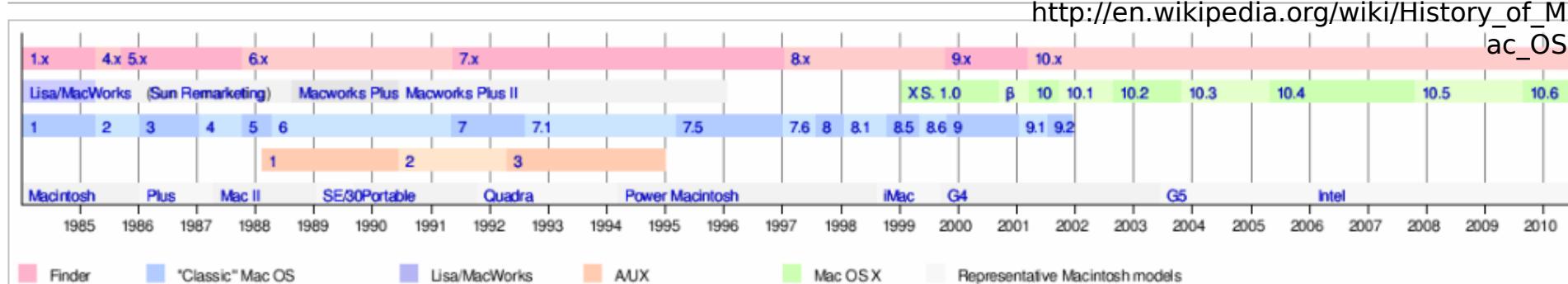


Dock & Stack



Preview

Timeline





Mac OS X 10.8 Mountain Lion (2012)



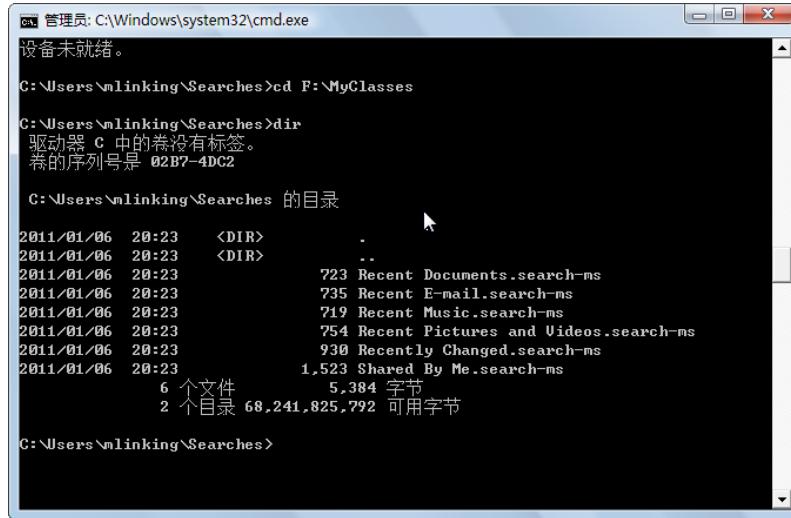
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Microsoft Team, ca. 1978. This photograph shows Microsoft as it was moving from Albuquerque, where the Altair was built, to the Seattle area, where **Bill Gates** (lower left) and **Paul Allen** (lower right) were from. (Source: Microsoft.)

The beginning of MicroSoft

- You have tried MS-DOS



```
管理员: C:\Windows\system32\cmd.exe
设备未就绪。

C:\Users\mlinking\Searches>cd F:\MyClasses

C:\Users\mlinking\Searches>dir
驱动器 C 中的卷没有标签。
卷的序列号是 02B7-4DC2

C:\Users\mlinking\Searches 的目录

2011/01/06 20:23 <DIR> .
2011/01/06 20:23 <DIR> ..
2011/01/06 20:23 723 Recent Documents.search-ms
2011/01/06 20:23 735 Recent E-mail.search-ms
2011/01/06 20:23 719 Recent Music.search-ms
2011/01/06 20:23 754 Recent Pictures and Videos.search-ms
2011/01/06 20:23 930 Recently Changed.search-ms
2011/01/06 20:23 1,523 Shared By Me.search-ms
2011/01/06 20:23 6 个文件 5,384 字节
2 个目录 68,241,825,792 可用字节

C:\Users\mlinking\Searches>
```

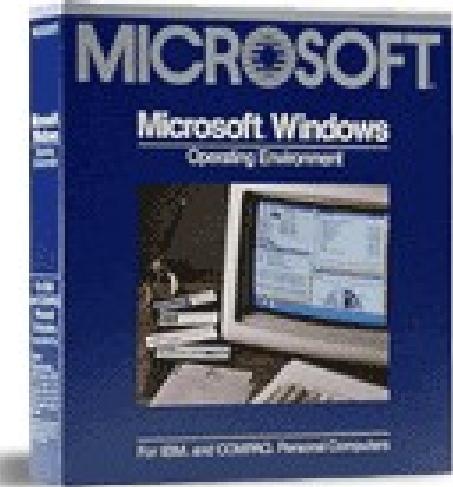
- Do you know the first Pot of Gold (第一桶金) for Gates?
 - The development tools for **Basic**

In 1978, MicroSoft was still a small company that focused mainly on supplying programming languages for personal computers. (Source: Microsoft.)



Microsoft Windows History

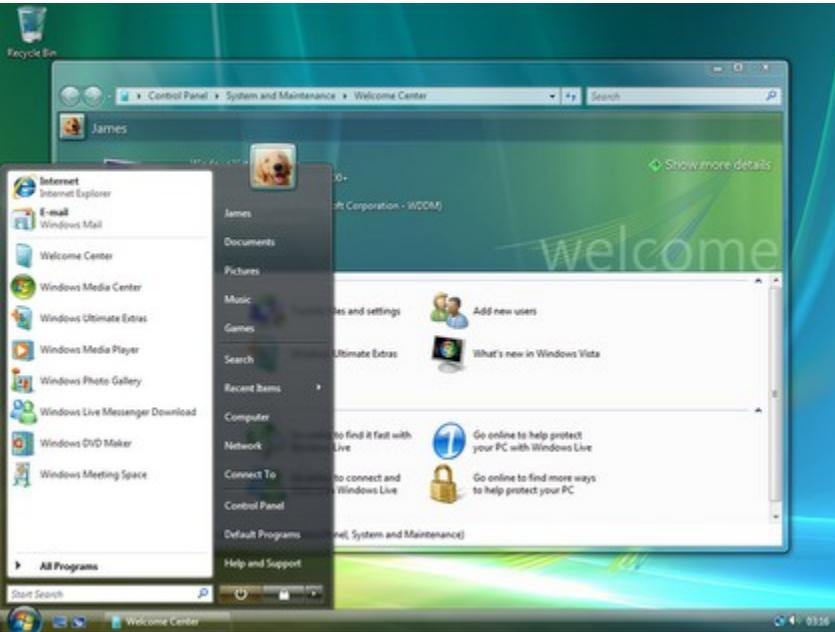
- 1983: Windows 1.0
 - Many longtime PC users trace the Microsoft Windows® operating system to the **1990** release of **Windows 3.0**, the first widely popular version of Windows and the first version of Windows many PC users ever tried.
 - However, Microsoft initially announced the Windows product seven years earlier and released the first version in **1983**.



The Windows 1.0 product box featured the operating system's new, tiled windows and graphical user interface (GUI).

Microsoft Windows History

- 2007: Windows Vista
 - Windows Vista is a line of operating systems developed by Microsoft for use on personal computers, including home and business desktops, laptops, Tablet PCs, and media center PCs.
 - Prior to its announcement on July 22, 2005, Windows Vista was known by its code name **Longhorn**.
 - Development was completed on November 8, 2006; over the following three months it was released in stages to computer hardware and software manufacturers, business customers, and retail channels.
 - On January 30, 2007, it was released worldwide, and was made available for purchase and download from Microsoft's websites.



The release of Windows Vista came more than five years after the introduction of its predecessor, Windows XP, the longest time span between successive releases of Microsoft Windows.

Microsoft Windows History

- Windows 7

- Windows 7 includes a number of new features, such as advances in touch, speech, and handwriting recognition, support for virtual hard disks, improved performance on multi-core processors, improved boot performance, and kernel improvements.

- According to reports sent to TG Daily, the Milestone 1 build of Windows 7 adds support for systems using multiple heterogeneous graphics cards from different vendors and a new version of Windows Media Center.

- New features in Milestone 1 also reportedly include Gadgets being integrated into Windows Explorer, a Gadget for Windows Media Center, the ability to visually pin and unpin items from the Start Menu and Taskbar, improved media features, the XPS Essentials Pack being integrated, Windows **PowerShell** Integrated Scripting Environment (ISE), and a multiline Calculator featuring Programmer and Statistics modes along with unit conversion.

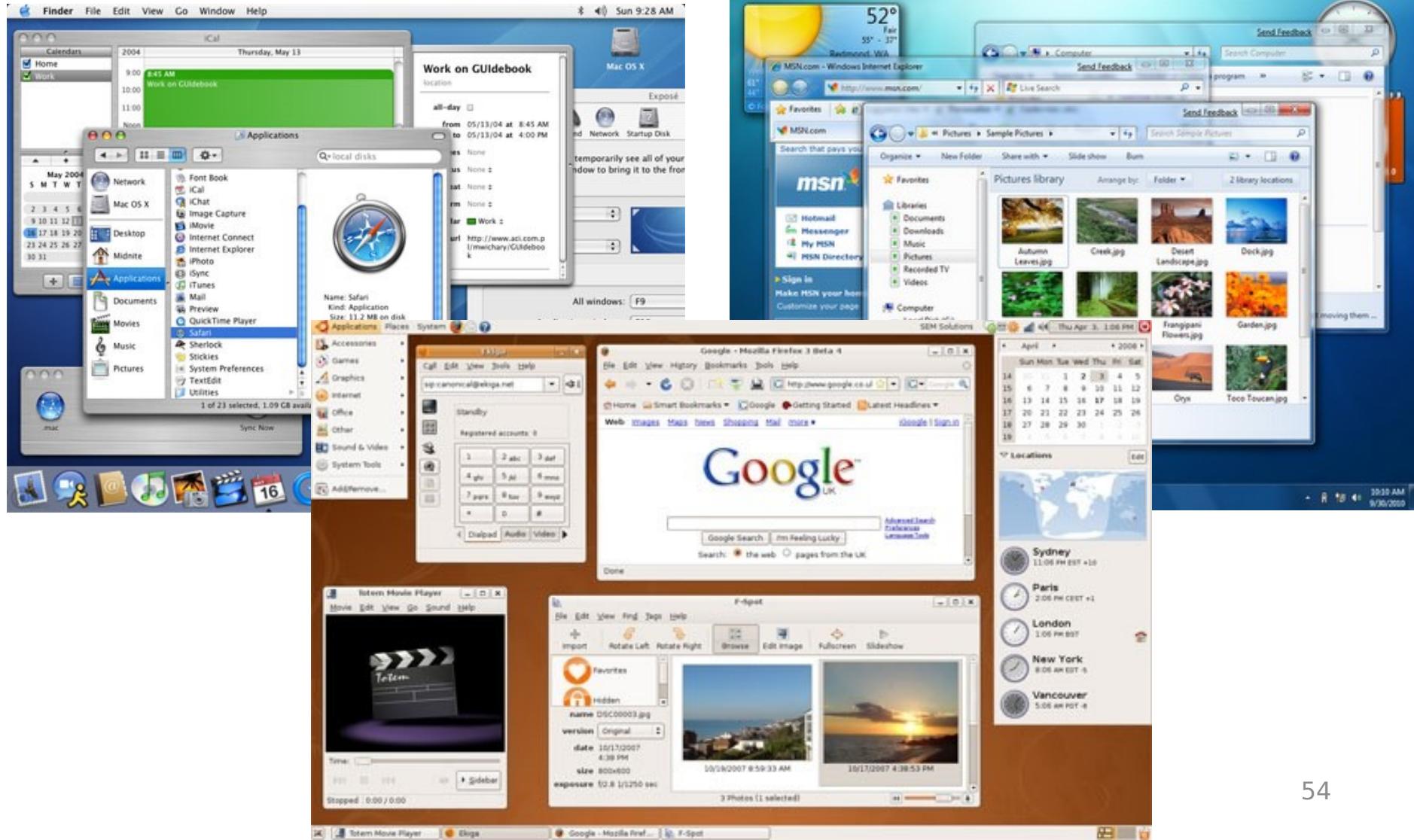


Windows 7 (formerly codenamed Blackcomb and Vienna) is the next release of Microsoft Windows, an operating system produced by Microsoft for use on personal computers, including home and business desktops, laptops, Tablet PCs, and media

Mac OS v.s Windows 7 v.s Ubuntu



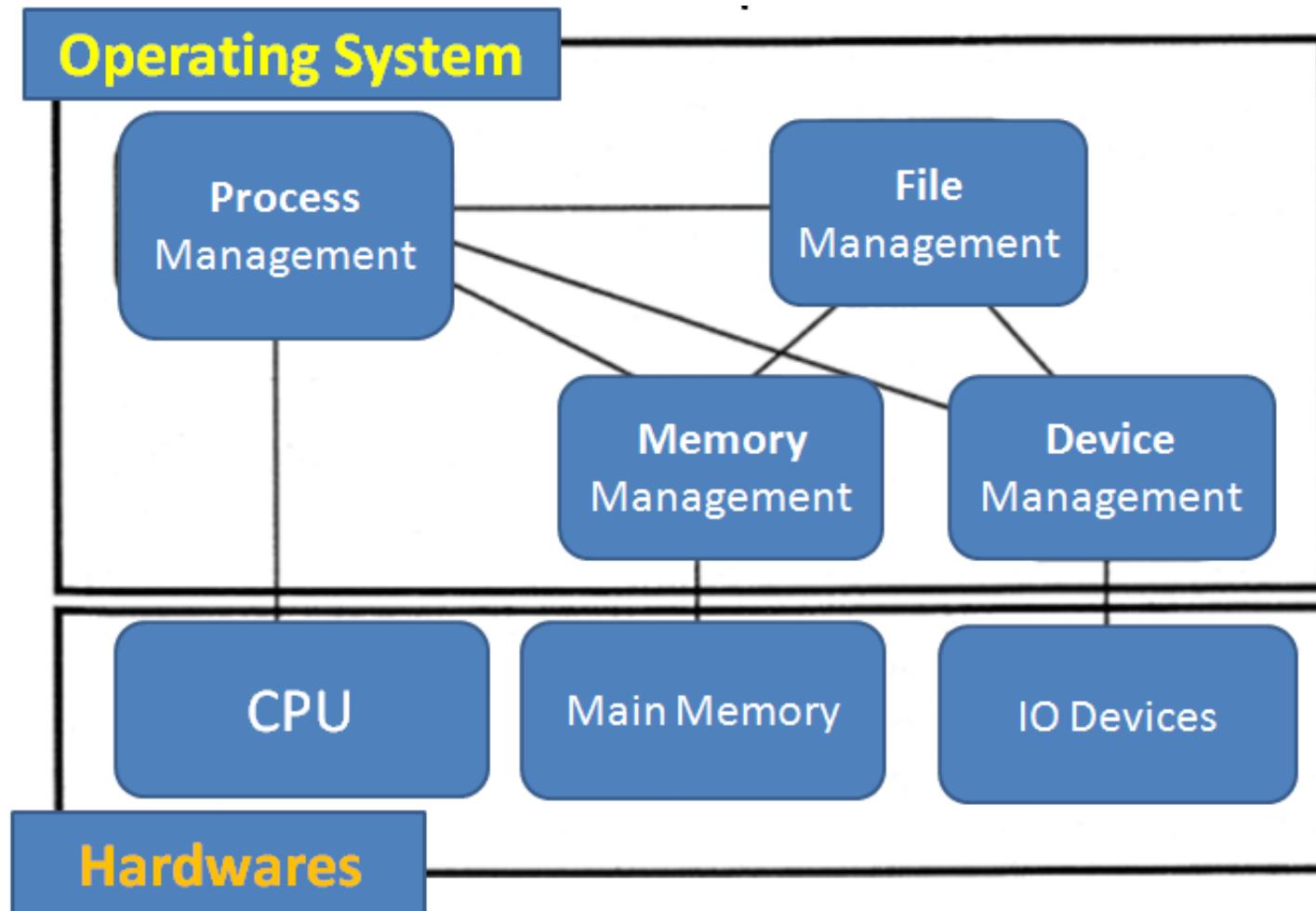
- More and more similar with each other in G





Mac OS v.s Windows 7 v.s Ubuntu

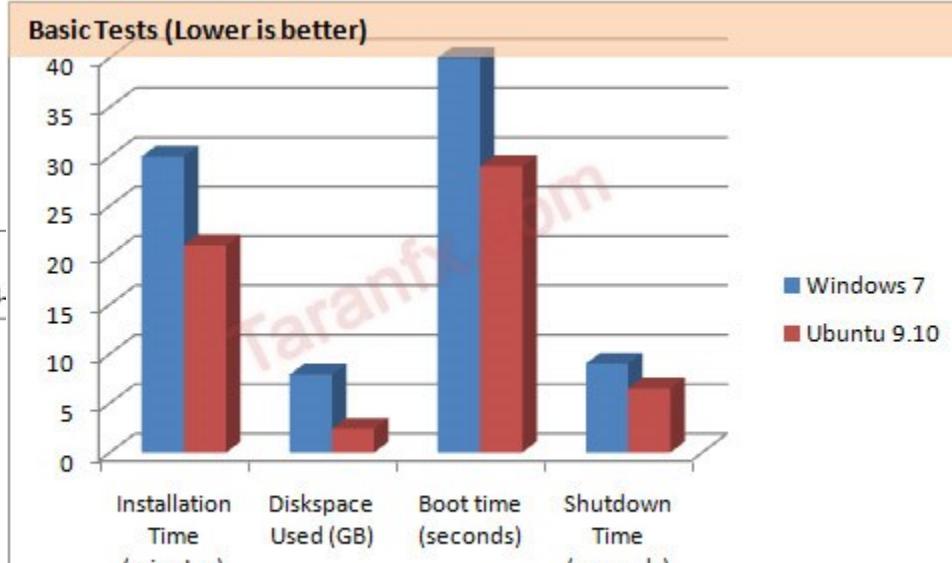
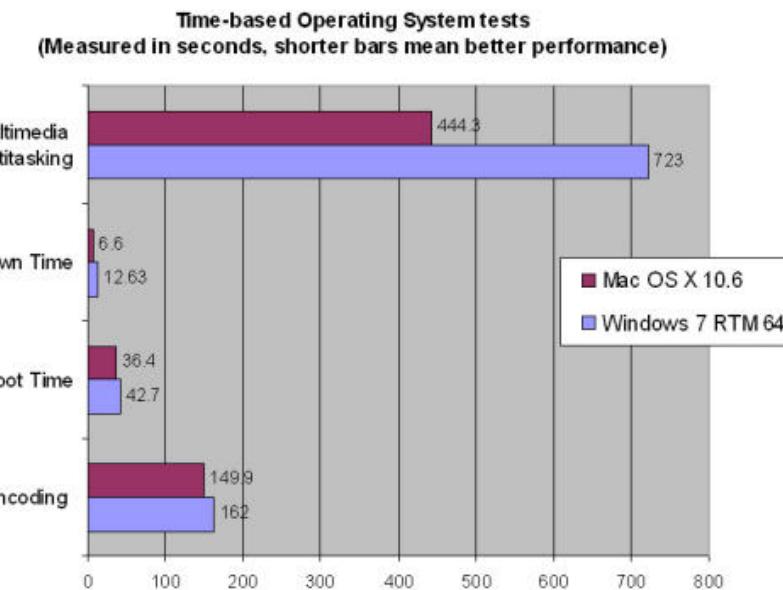
- Of course they provide similar fundamental functions





Mac OS v.s Windows 7 v.s Ubuntu

- Performance?
 - Mac OS & Ubuntu are both better than Windows 7 (Of course)
 - They are well-matched with each other



<http://www.taranfx.com/windows-7-vs-ubuntu>

http://reviews.cnet.com/8301-31012_7-10319612-10355804.html



Mac OS v.s Windows 7 v.s Ubuntu

- For me
 - I have to use Windows 7
 - Benefitting from the “Piratical [盜版] strategy” of MS
 - I am trying Ubuntu
 - Excellent. But it’s still complicated in some settings
 - I love to try Mac OS later
 - It’s graceful, but some operations are against my habits which are trained from MS