



Operating Systems (Honor Track)

Lecture 3: OS History

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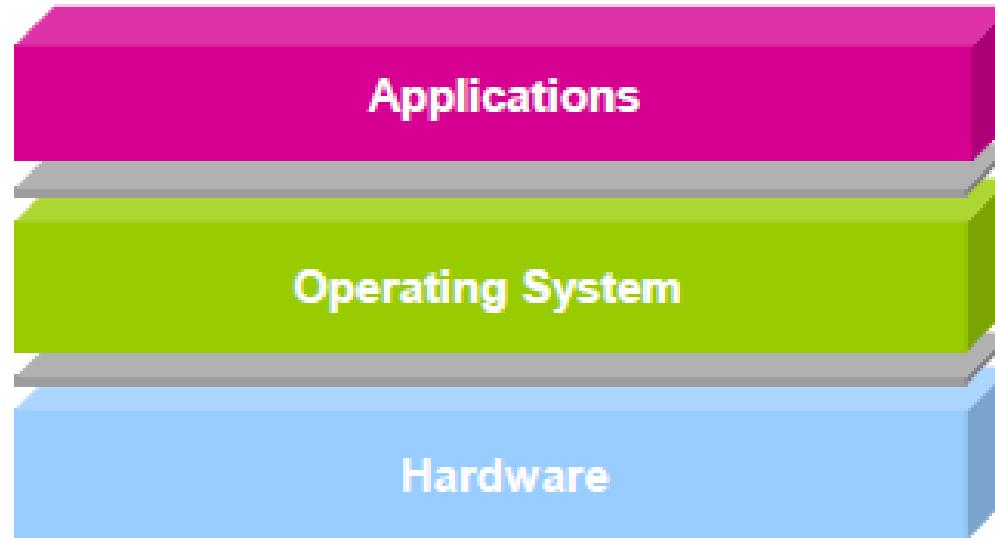
Review



Introduction to OS

OS Is...

- The operating system is the software layer between user applications and the hardware



- The OS is “**all the code that you didn’t have to write**” to implement your applications



What Does an OS Do?

Resources

- Allocation
- Protection
- Reclamation
- Virtualization

Services

- Abstraction
- Simplification
- Convenience
- Standardization

An OS makes computers simpler!

This Lecture



OS History and Future



Buzz Words

Batch system

Multiprogramming

Spooling

Time-sharing



History of Computer Systems and OSes

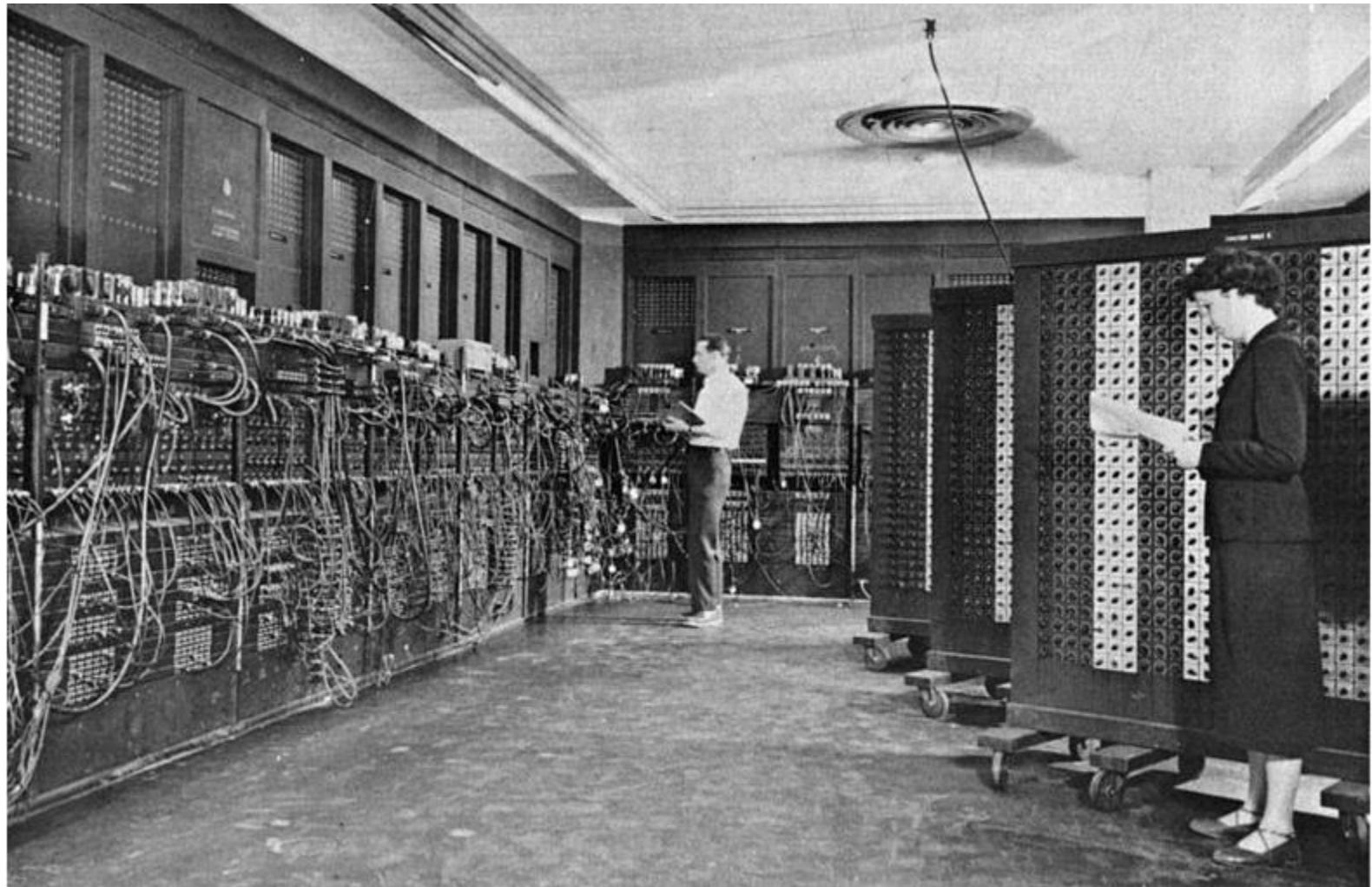
□ Generations:

- Gen1: (1945–55) Vacuum Tubes
- Gen2: (1955–65) Transistors and Batch Systems
- Gen3: (1965–1980) ICs and Multiprogramming
- Gen4: (1980–Present) Personal Computers
- Gen5: (1990-Present) Mobile Computer

- Gen6?



Gen1: Vacuum Tubes



Glen Beck (background) and Betty Snyder (foreground) program ENIAC in BRL building 328. (U.S. Army photo)

Gen2: Transistors and Batch Systems (1)



□ IBM 7090

Gen2: Transistors and Batch Systems (2)

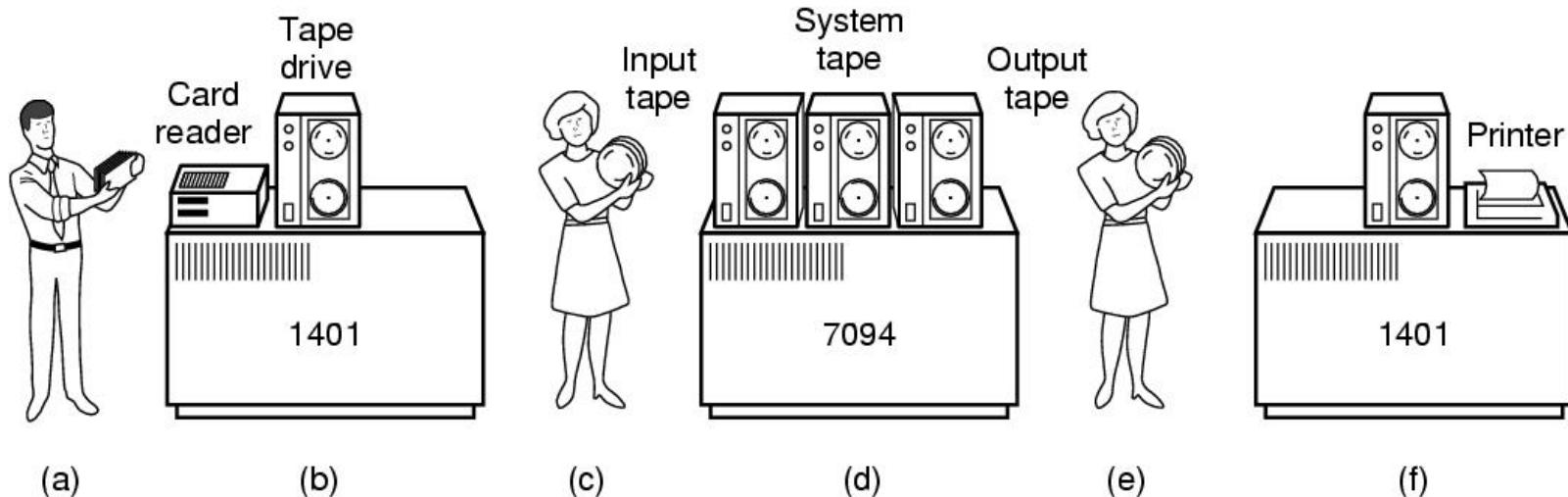


Figure 1-3. An early batch system.

- (a) Programmers bring cards to 1401
- (b) 1401 reads batch of jobs onto tape
- (c) Operator carries input tape to 7094
- (d) 7094 does computing.
- (e) Operator carries output tape to 1401
- (f) 1401 prints output

Gen2: Transistors and Batch Systems (3)

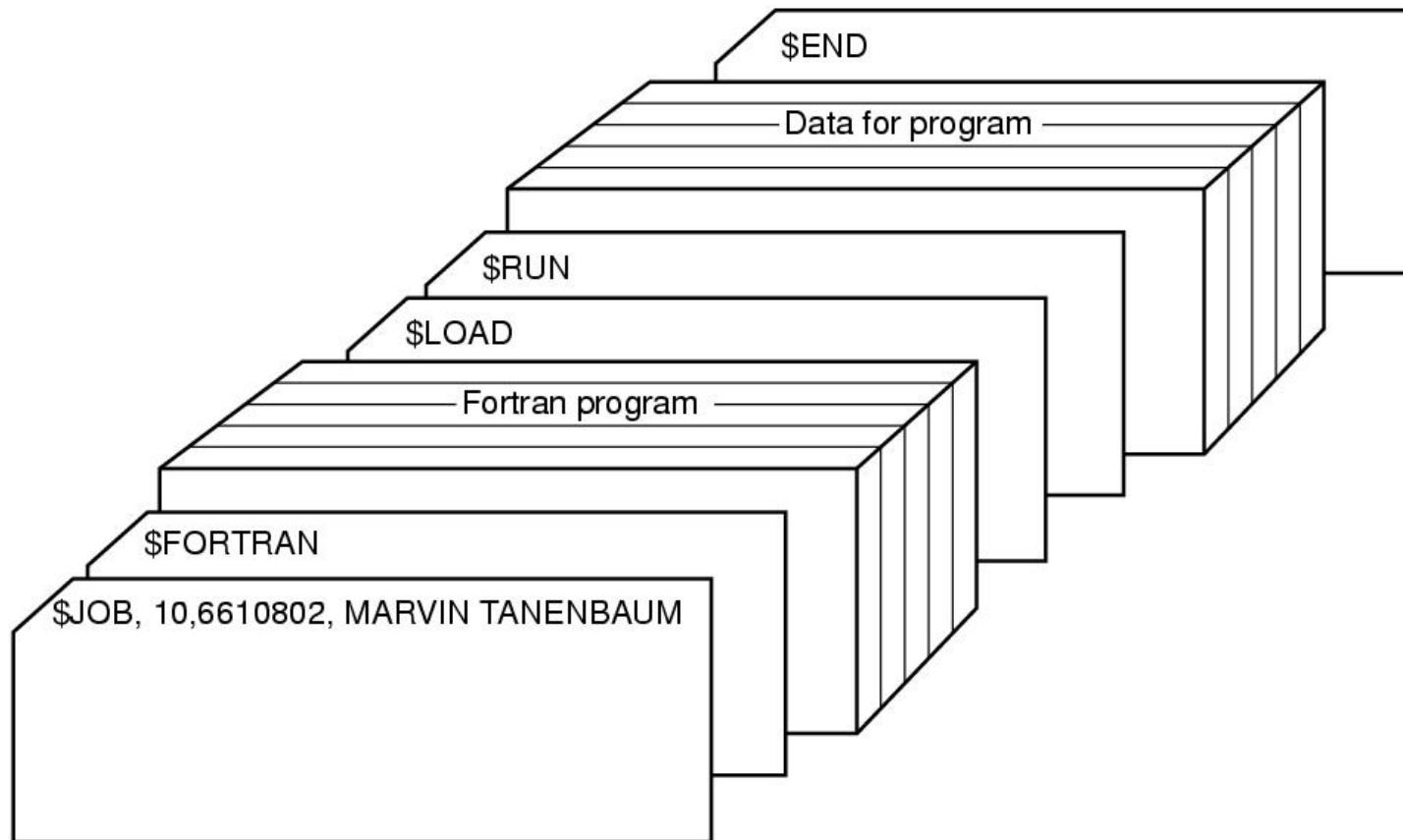
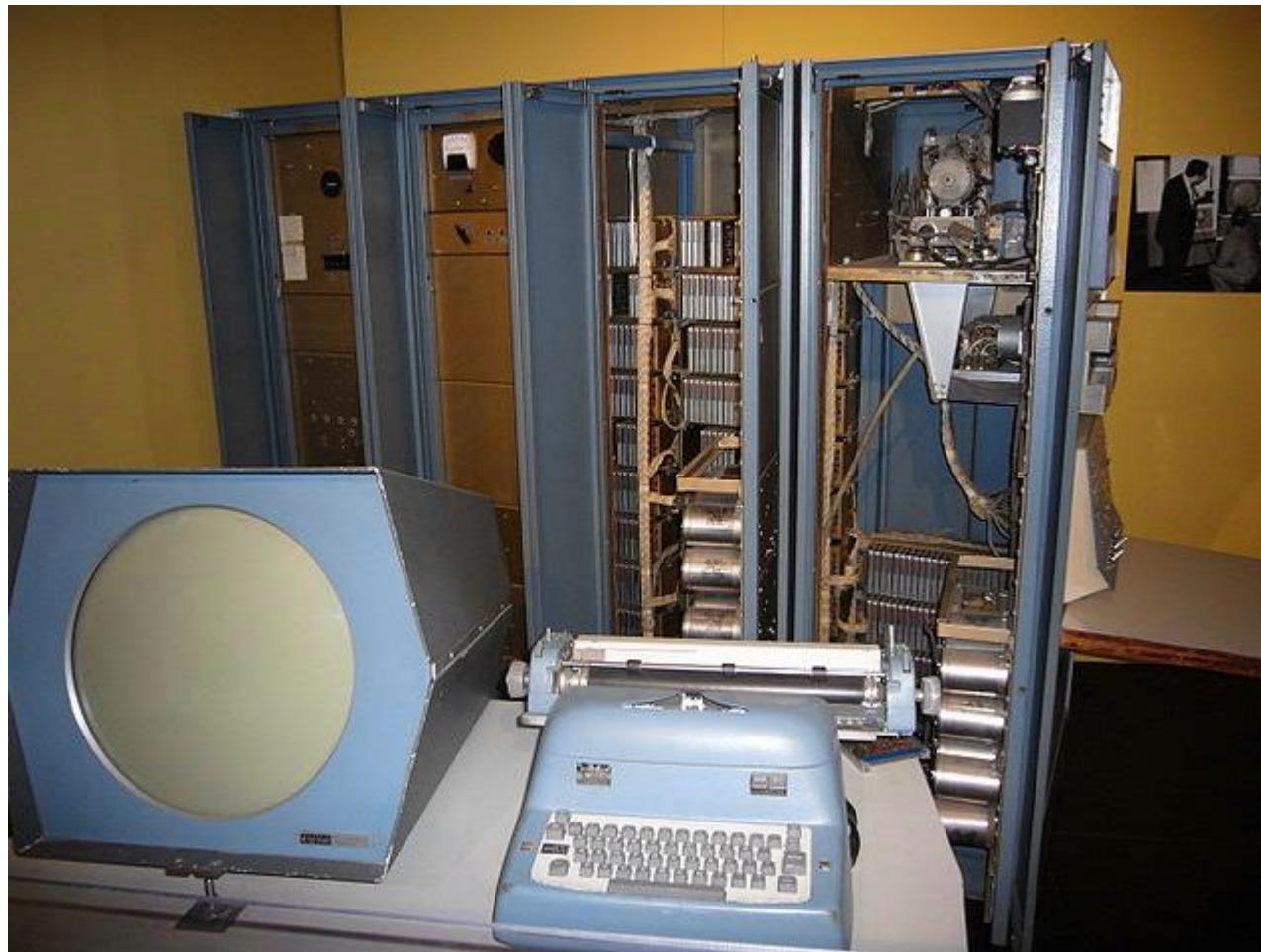


Figure 1-4. Structure of a typical FMS (the Fortran Monitor System) job.

Gen3: ICs and Multiprogramming (1)



IBM System/360

SPOOLing

Time-sharing

Mini-computer

PDP-1, 7, 11,...

Ken Thompson

UNIX

.....

The PDP-1 (Programmed Data Processor-1, DEC) was first produced in 1960. It was also the original hardware for playing history's first game on a minicomputer, Steve Russell's Spacewar! –
Source: Wikipedia

Gen3: ICs and Multiprogramming (2)

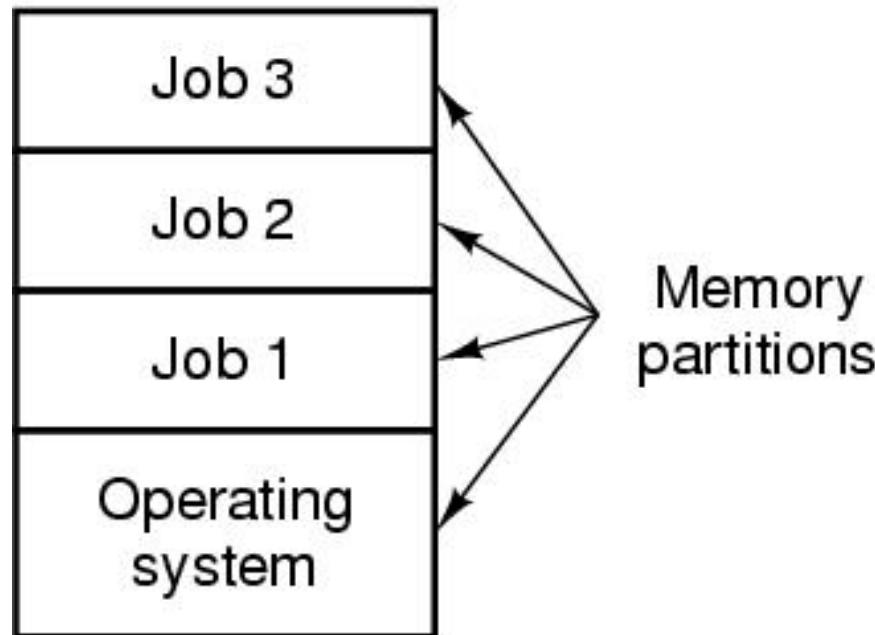


Figure 1-5. A multiprogramming system with three jobs in memory.

Gen4: Personal Computers (1)

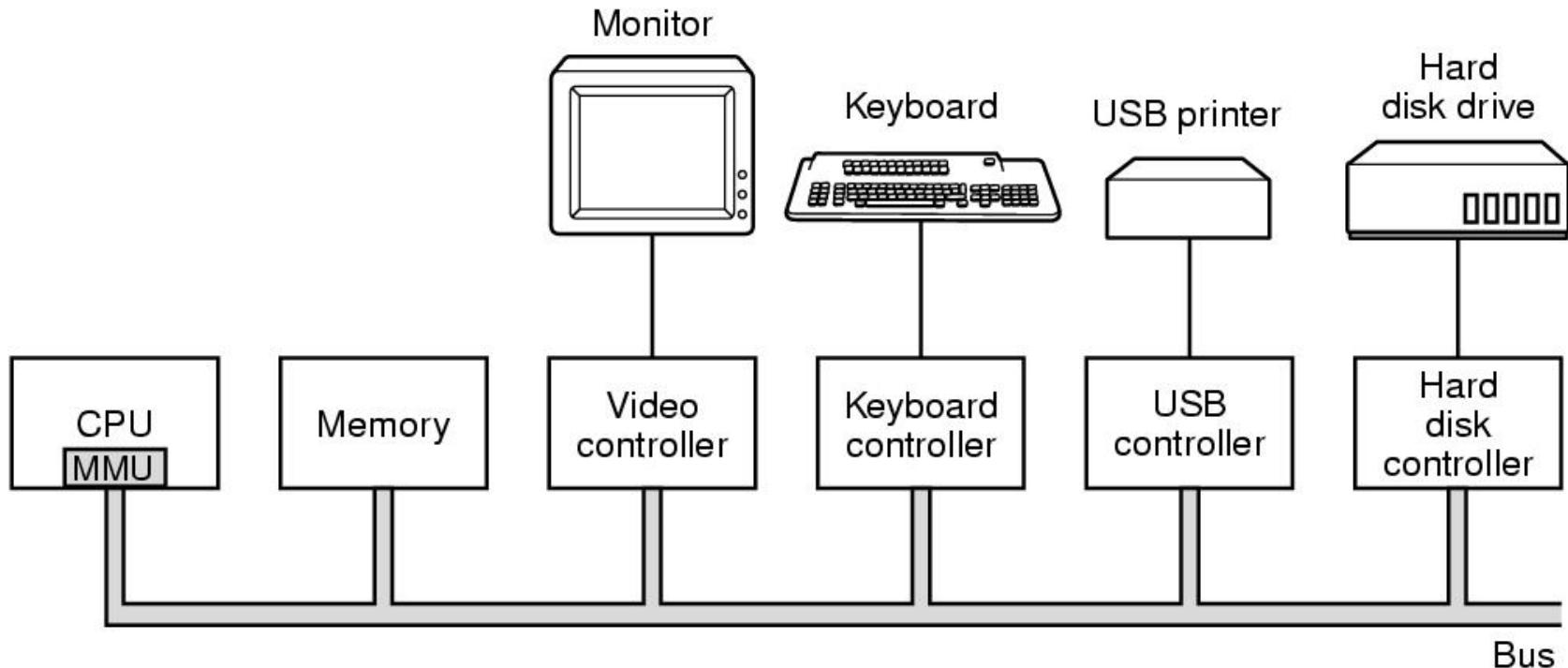


Figure 1-6. Some of the components of a simple personal computer.



Gen4: Personal Computers (2)

- Intel 8080, 8086, 8088, 80286, 80386, 80486,
Pentium, Core, ...
- AMD, ...
- Motorola 6502, 68000, ...

- IBM PC, Apple II, ...

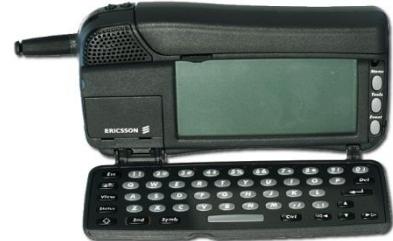
- CP/M, DOS, Windows, Unix/Linux, Mac OS



Gen5: Mobile Computers

The first real mobile phone appeared in 1946 and weighed some 40 KG.

- 1990s: PDA (Personal Digital Assistant)
- Smartphone: In 1997, Ericsson coined the term smartphone for its GS88 “Penelope.”
- Nokia: Symbian series
- Blackberry, iPhone (2007), Android (2008)
- iOS, Android, Windows CE/Mobile





Questions to Ponder

- Is there an OS that has been the best along the history of computer systems? Why?

- Is there an OS that is the best in all situations now? Why?

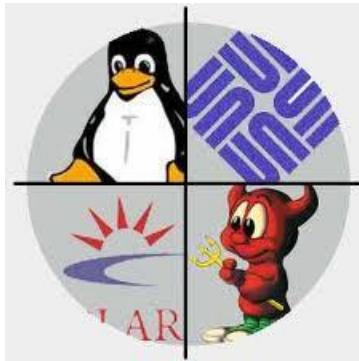
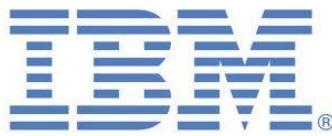
- What will be the OS for a Gen6 computer?



Historical Comparison

	Mainframe (Gen2 ~)	Mini (Gen3 ~)	Micro/Mobile (Gen4)
System \$ / Worker Salary	10:1 – 100:1	10:1 – 1:1	1:10-1:100
Goal	System utilization	Overall cost	Productivity
Target	Capacity	Features	Ease of Use

Summary: OS History in One Slide



1956:
The first
practical OS
(IBM 704):
GM-NAA I/O

1960s:
Mainframe OS
IBM OS/360
series

1970s:
Workstation OS:
UNIX

1980-90s: PC OS
Mac OS,
Windows, Linux

2000s: Smartphone OS
iOS, Android, Windows
Phone, etc.

- Simple batch processing
- I/O management

- Batch processing
 - Time-sharing
- Device/memory management
- Virtual machines

- First modern OS
- Developed with machine-independent language
- Standard interfaces
 - Includes IDEs

- Provides modern human interface (GUI)

- Customization of traditional OSs
- Focusing on usability
- New app ecosystem (App Store, Google Play, etc.)

New Types of OSs in the Internet Era

- Tim O’Riley (2010) : The State of the Internet Operating System
 - “Cloud computing” platforms like Amazon Web Services, Google App Engine, or Microsoft Azure, which provide developers with access to storage and computation, are the heart of the emerging Internet Operating System.
 - A “modern” Internet Operating System contains:
 - Search
 - Media Access
 - Identity and the Social Graph
 - Payment
 - Advertising
 - Location
 - Image and Speech Recognition



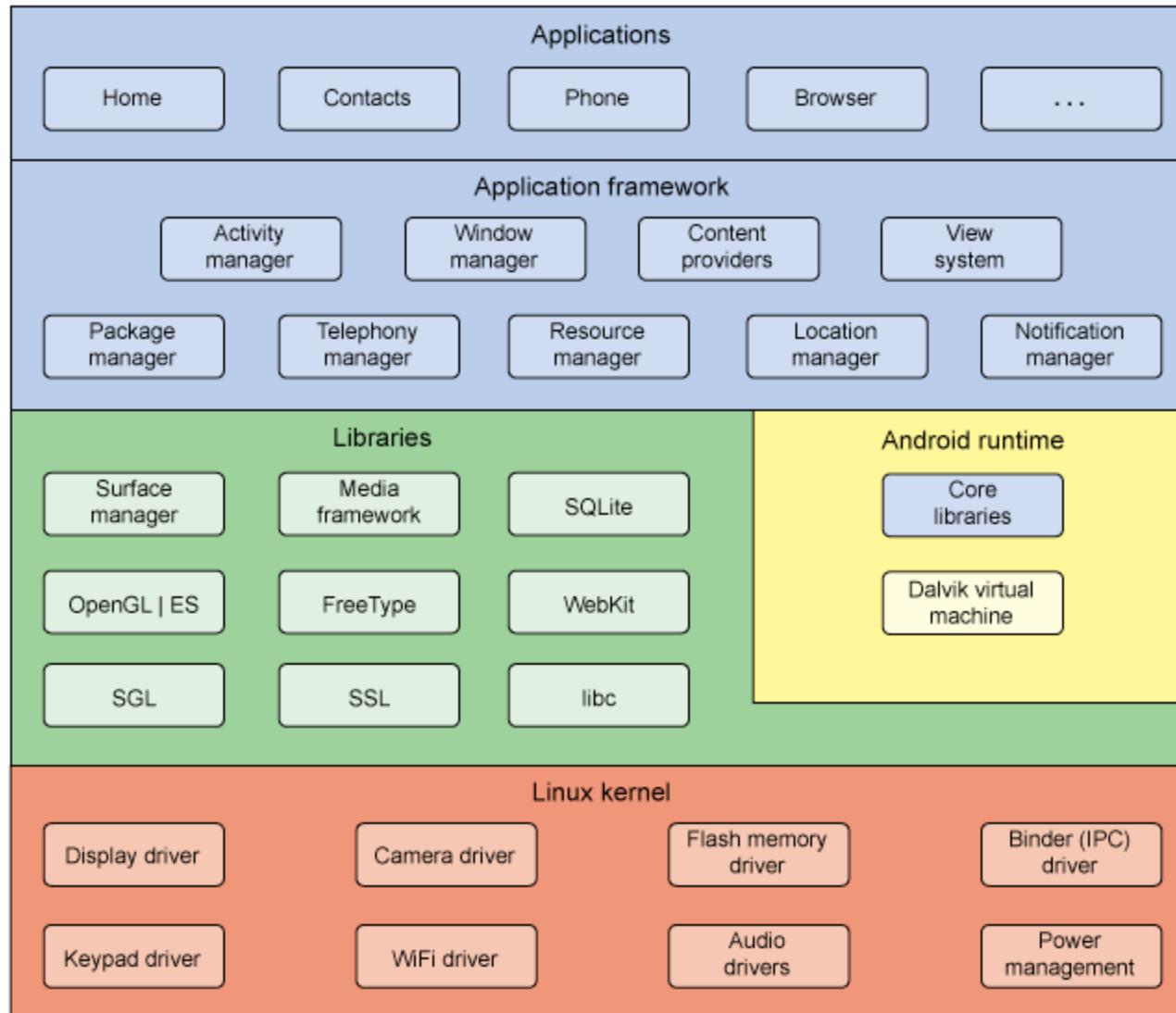


Many “Modern” OSs are Meta-OSs

- A meta-OS runs on top of traditional OSs such as Windows and Linux, providing abstractions at a higher-level
- Meta-OSs offer exactly the same functionalities as traditional OSs
 - Resource management and virtualization, at a higher-level
 - Application support, such as libraries and SDKs, on top of the traditional libraries
- For example, Android is a typical Meta-OS

Many “Modern” OSs are Meta-OSs

- A | such
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Urban OS: OS for Smart City

□ The Urban Operating System (UOS™)

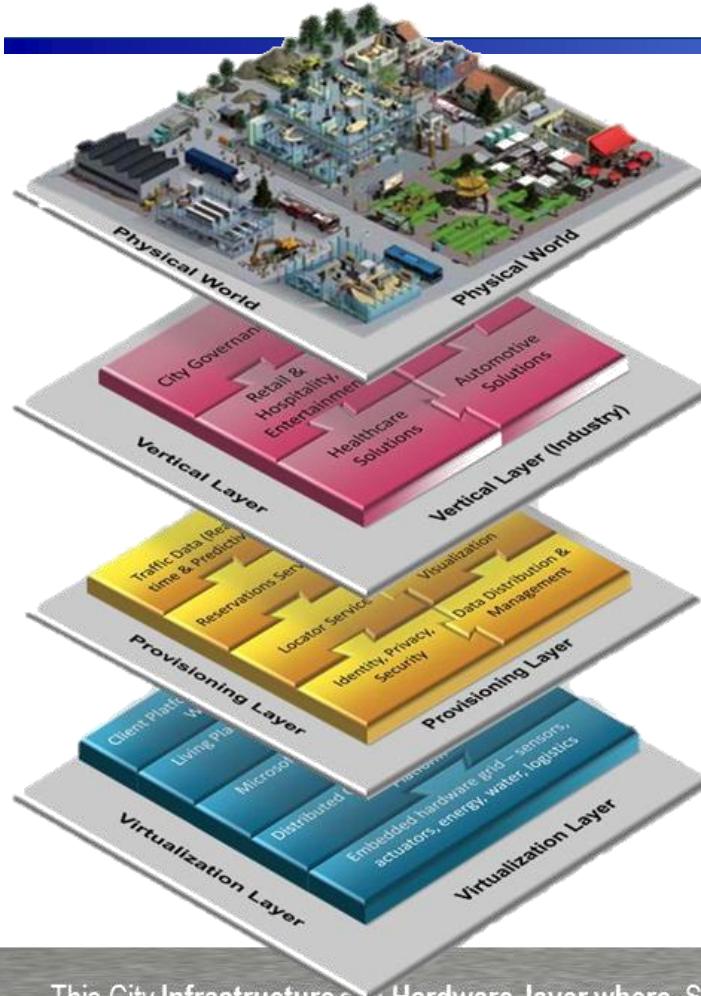
- Proposed by a UK company Living Plan IT, adopted by the city of London to build a “smarter city”
- Provides abstractions and management interfaces for energy, water, waste management, transportation, telecommunications, and healthcare systems
- Programming APIs to ensure interoperability among different platforms.

□ Examples of Urban OS apps

- Smart street lighting (Philips)
- Smart house lighting (UNA)
- DaVinci: smart building design



Urban OS: OS for Smart City



This City Infrastructure and Hardware layer where Sensors, actuators and other data sources are embedded in the physical environment

- Utilities Infrastructure: Energy, Water and Waste
- Road and Transport Infrastructure
- ICT Infrastructure

An OS for the Home

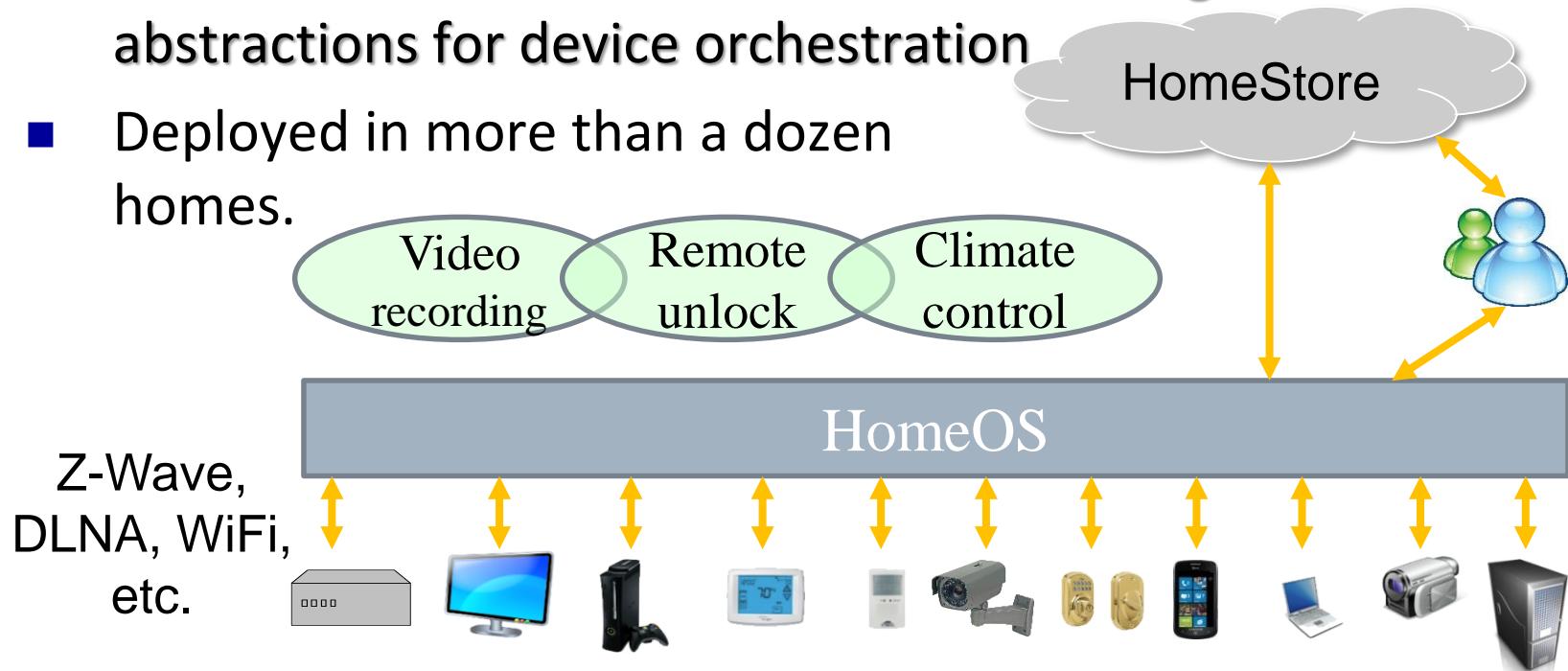


HomeOS



- HomeOS: A Microsoft initiative to enable “**smarter homes for everyone**”

- Aims to simplify the creation and management of home automation technology
- Provides both intuitive user controls and higher-level abstractions for device orchestration
- Deployed in more than a dozen homes.





Other Types of “new” OSs

□ Cloud OSs

- A cloud OS does what a traditional OS **does—manage applications and hardware—but at the scale of cloud computing**
- E.g., Microsoft Azure, Amazon AWS, Google Cloud



Google
Cloud Platform



□ Robot OSs

- **ROS**: a meta-OS that provides **development and runtime support for complex and robust robotic**



□ Web OSs

- Provide a Linux-like environment within a browser for users to **run applications and manage all their data and storage.**
- E.g., Firefox OS, Chrome OS, eyeOS, YouOS, G.ho.st.



Firefox OS

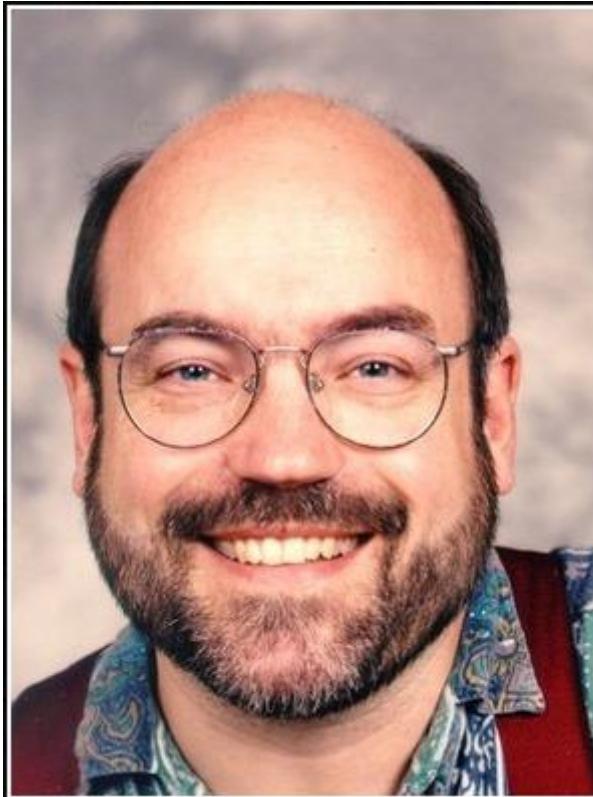


eye os



OSs are Becoming Ubiquitous too!

Mark Weiser: Ubiquitous Computing



The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.

— Mark Weiser —

AZ QUOTES

Mark Weiser, “The Computer for the 21st Century,” Scientific Am., vol. 265, no. 3, 1991, pp. 94–105.



UOS: Ubiquitous Operating Systems

- **Ubiquitous operating systems (UOSs)** represent a new set of operating systems beyond the traditional OSs such as Linux and Windows.
 - A new layer of software can be regarded as a form of OS if it provides similar functionalities as an OS, i.e., **managing underlying resources and providing programming capability to the applications running above**

COVER FEATURE OUTLOOK

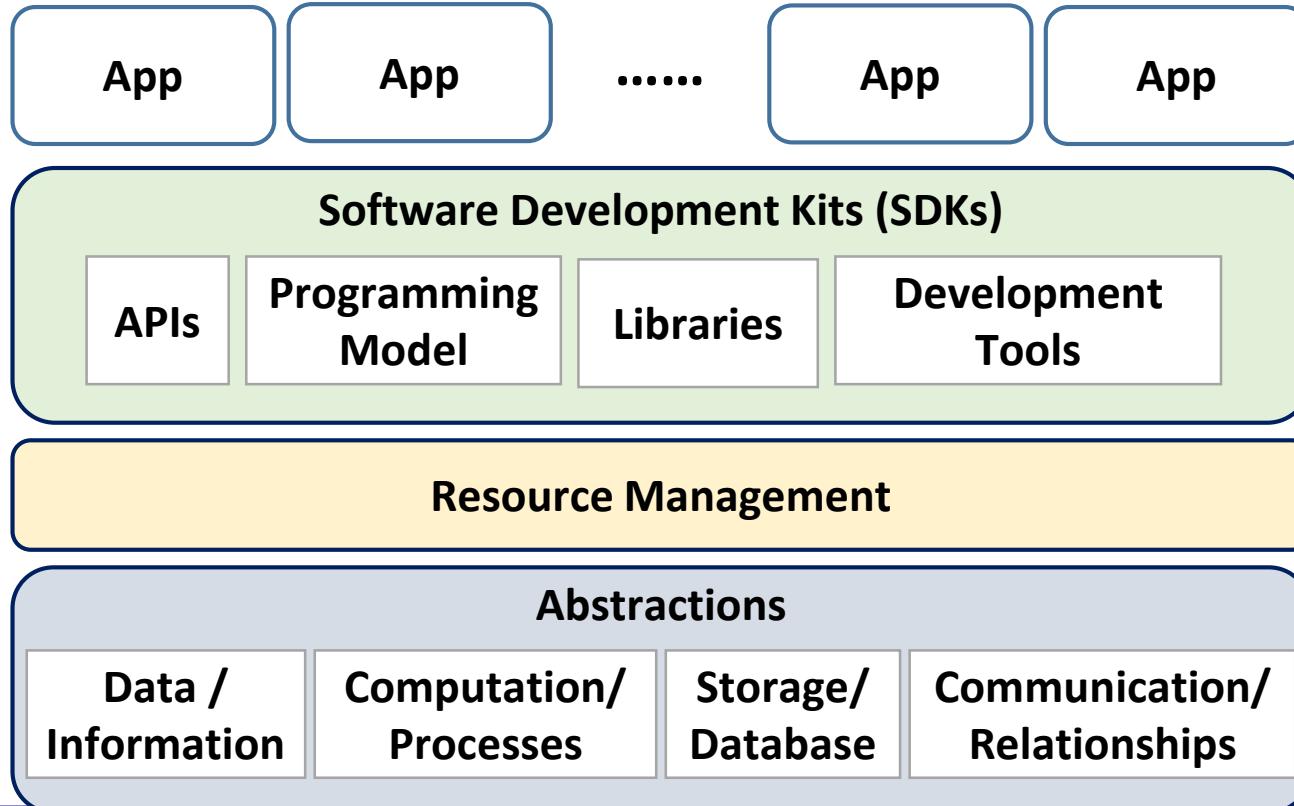
Toward Ubiquitous
Operating Systems:
A Software-Defined
Perspective

For more information:
Hong Mei, Yao Guo,
**"Toward Ubiquitous Operating
Systems: A Software-Defined
Perspective"**,
Computer, Vol. 51, No. 1, pp. 50-56,
January 2018.



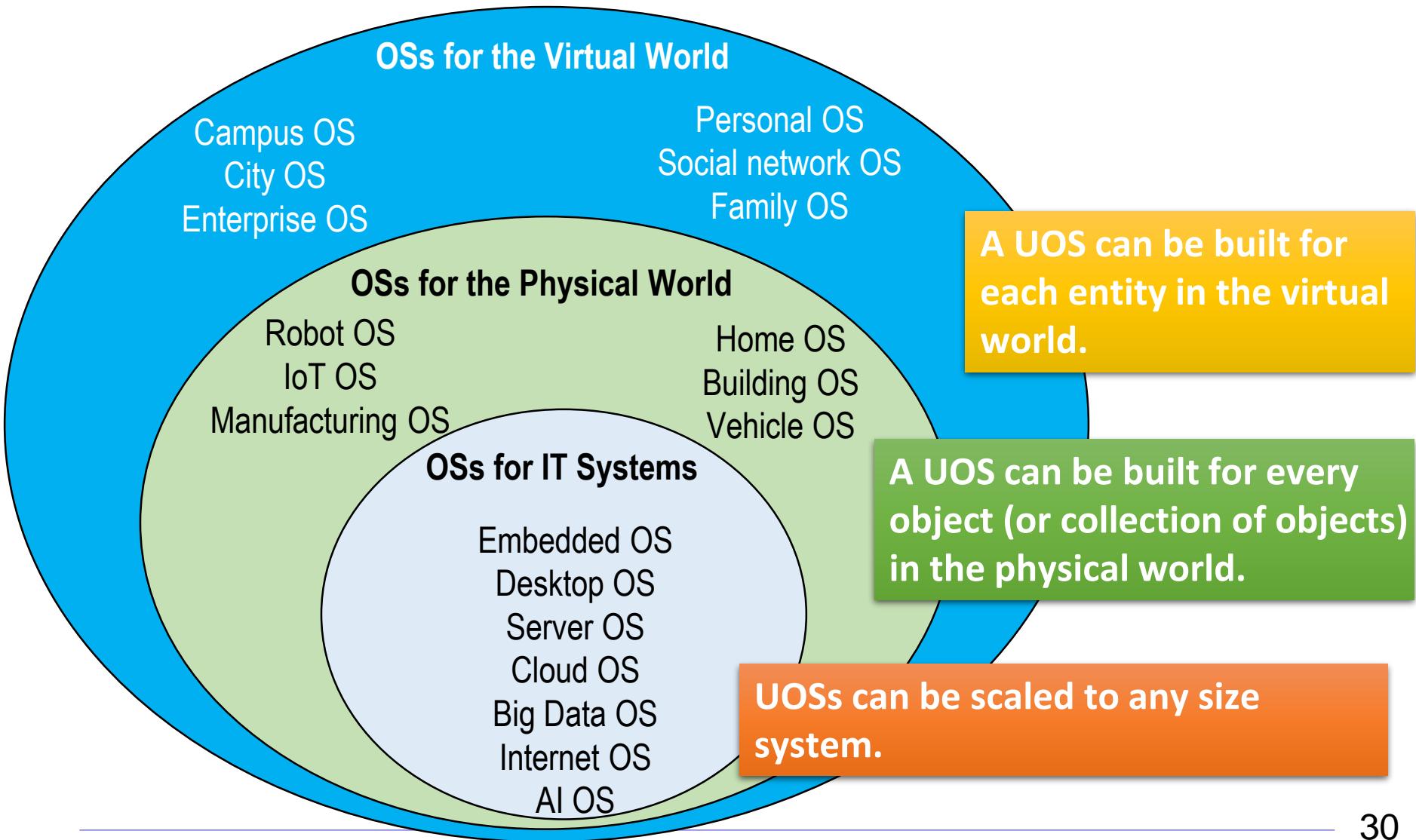
A General UOS Architecture

- A UOS provides abstractions to manage hardware and software as well as resource virtualization along with programming and runtime support for applications.





An Outlook on UOSs





Homework #1

- Find the information (paper, product, website, or propose one yourself) of a new kind of OS.
 - Write a short presentation (4-5 pages)
 - What are its main functionalities?
 - What are the new (or special) features?
 - Comparing it with traditional OSes such as Windows/Linux
 - What are the main differences?
 - What are the similarities?
 - You can work on it in groups of three
 - Due: 9/26 (Sun) 23:59
 - ALL: Be prepared to give a 5 min presentation next week (9/27 or 9/29).



Summary

- OS history
 - Five generations of computers
 - vacuum tubes
 - transistors and batch systems
 - ICs and multiprogramming
 - personal computers
 - mobile computers
 - Historical comparison
 - Future OSs
- Next lecture: Von Neumann Architecture