EECS 111:

System Software

Lecture: Introduction

Prof. Mohammad Al Faruque

The Henry Samueli School of Engineering
Electrical Engineering & Computer Science
University of California Irvine (UCI)

Lecture: outline

- Course Management
- What is System Software?
- Open Discussion
- Introduction to System Software (OS in general)

Course Management

- Web link: https://eee.uci.edu/16s/18080/

SYSTEM SOFTWARE
EECS 111, Course Code: 18080
Quarter: Spring Quarter 2016

Home | Syllabus | Schedule | Assignments | Discussion | MessageBoard | Resources

EECS 111, Spri

- Course El
- This cours
- This cours

User name: eecs111
Password: eecs111

Announcement

- **Lectures will begin** from **March 29th 2016 at 11:00 AM (PSCB 140)**
- Every week Tuesday and Thursday, we will meet from 11:00 AM till 12:20 PM
- Every week Friday, we will meet from 8:00 AM till 8:50 AM for the first discussion session (**NS1 3116**)
- Every week Friday, we will meet from 9:00 AM till 9:50 AM for the second discussion session (**NS1 3116**)
- Every week Friday, we will meet from 10:00 AM till 10:50 AM for the third discussion session (**NS1 3116**)
- Please see the Class Announcements on the Course MessageBoard!
- **Final Examination** is scheduled for **Tuesday, June 7th, in between 10:30 AM till 12:30 PM at PSCB 140**.
- **Midterm Examination** will be on April 28th

Course Management

Lecture: Every week Tuesday and Thursday we will meet from 11:00 AM till 12:20 PM

Discussion:

- Every week Friday, we will meet from 8:00 AM till 9:50 AM for the **first discussion session** (NS1 3116)
- Every week Friday, we will meet from 9:00 AM till 9:50 AM for the **second discussion session** (NS1 3116)
- Every week Friday, we will meet from 10:00 AM till 10:50 AM for the **third discussion session** (NS1 3116)

Office hours: Tuesday at 12:30 PM till 14:30 PM and with appointments if needed (EH3223)

Communication

Office hours: Tuesday at 12:30 PM till 14:30 PM and with appointments if needed (EH3223)

MessageBoard

https://eee.uci.edu/toolbox/messageboard/m17962/

E-mail → Anytime 24/7 but if general question pls post in the messageboard.

What is System Software?

- **System software** is a type of computer program that is designed to run a computer's hardware and application programs. If we think of the computer **system** as a layered model, the **system software** is the interface between the hardware and user applications.

- **System software** (or systems software) is computer software designed to operate and control the computer hardware and to provide a platform for running application software.

What is System Software?

- System software includes the following:
  - The **operating system** (prominent examples being, Microsoft Windows, Mac OS X and Linux), allows the parts of a computer to work together by performing tasks like transferring data between memory and disks or rendering output onto a display device. It also provides a platform to run high-level system software and application software.
  - **Utility software** helps to analyze, configure, optimize and maintain the computer.
  - **Device drivers** such as computer BIOS and device firmware provide basic functionality to operate and control the hardware connected to or built into the computer.
  - **A user interface** "allows users to interact with a computer." Since the 1980s the graphical user interface (GUI) has been perhaps the most common user interface technology. The command-line interface is still a commonly used alternative.

What is System Software?

- Sometimes, the term system software **also includes software development tools** (like a compiler, linker or debugger).
- In contrast to system software, software that allows users to do things like create text documents, play games, listen to music, or surf the web is called **application software**.

Course Description

Q2. "What are the objectives or outcomes in *this* class?"

http://plaza.eng.uci.edu/course/eecs/111/outline/2015-2016

- **Students will:**

1. **Structure concurrent programs composed of processes and threads. (EAC a, EAC c, EAC e, EAC k)**

2. **2.Describe basic CPU scheduling techniques. (EAC a, EAC b, EAC c, EAC e, EAC k)**

3. **Describe the principles and techniques for designing and analyzing concurrent processes capable of correct synchronization among themselves. (EAC a, EAC b, EAC c, EAC e, EAC k)**

Course Description

4. Describe the principles and techniques for designing and analyzing concurrent processes capable of avoiding or recovering from deadlocks. (EAC a, EAC c, EAC e, EAC k)

5. Describe the principles and techniques for designing and analyzing memory management mechanisms including virtual memory. (EAC a, EAC c, EAC e, EAC k)

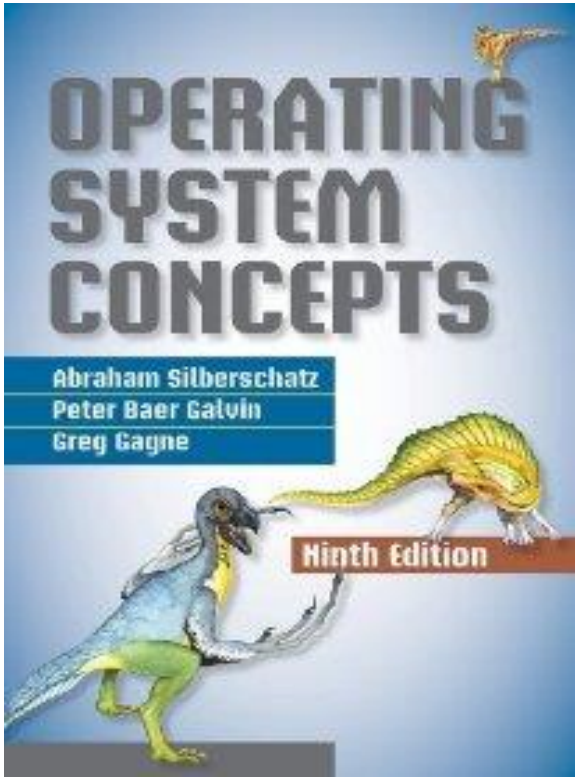
Course Description

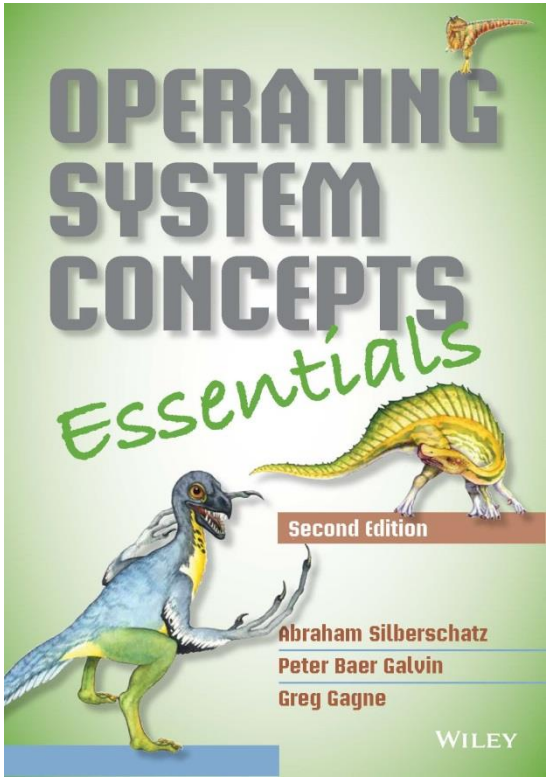
- EECS111 System Software → Study of OS including
  - Introduction to OS
  - OS structures
  - Processes
  - Threads
  - Process/Thread Synchronization,
  - CPU Scheduling,
  - Deadlocks,
  - Main memory, Storage, etc. → Memory and Storage management
  - File Systems.

Course Description

- **Prerequisite:** EECS112; CSE46, ICS 46 or EECS114.
  - Only one course from EECS 111, COMPSCI 143A, CSE 104 may be taken for credit.
- **Note: This course covers introductory topics in operating systems.**
- **There will be practical projects during this course.**
- **Students have to implement various properties of OS using JAVA and C programming languages.**
- **We will be using Light version of Nachos OS for this course.**
- **Therefore. it is expected that the students have sufficient knowledge from their computer engineering education on:**
  - **EECS112, CSE46, ICS 46 or EECS114 : Data Structure.**
  - **Also Computer Architecture (MIPS), Programming (C, JAVA),**

Major Text Book





Abraham Silberschatz, Peter B. Galvin, Greg Gagne: "*Operating System Concept* ", Publisher : Wiley; 9 edition (December 17, 2012), ISBN-13: 978-1118063330

Course Policy

- **Attendance Policy:**
  - **Attendance and active participation are required.**

- **Exams:**
  - **Midterm will be on Thursday, April 28th 2016 (in the last lecture of 5th week) in between 11:00 AM till 12:20 PM at PSCB 140.**

  - **Final Exam Tuesday, June 7th, in between 10:30 AM till 12:30 PM at PSCB 140.**

Grading Policy and Academic Honesty

This course grading will be distributed as follows:

Part	Share
Homework	10%
Lab assignment and Quiz during the lecture sessions	30% (programming part 25% and quiz about theory 5%)
Mid term (April 28th 2016)	20%
Final exam (June 7th, 2016)	40%

- **Academic Honesty:**
  - **The complete policy statement on academic honesty is published in the UCI Schedule of Classes, Spring Quarter 2016.**

Dishonesty will not be tolerated.

Course Policy

- **Programming assignments**
  - **8th April TA will discuss the details.**
- **Midterm exam:**
  - **It will be 1 hour exam (if there is any change in the policy we will inform at least 1 week before the exam)**
    - True/False
    - Multiple choices
    - Problems solving
    - Essay-type
- **Final exam will be similar**
  - **More information will be provided if other than midterm 1 week before the final.**

Lecture: outline

- Course Management
- What is system Software?
- Open Discussion
- Introduction to System Software (OS in general)

What is an Operating System?

- A program that acts as an intermediary between a user of a computer and the computer hardware

- Operating system goals:
  - Execute user programs and make solving user problems easier
  - Make the computer system convenient to use
  - Use the computer hardware in an efficient manner

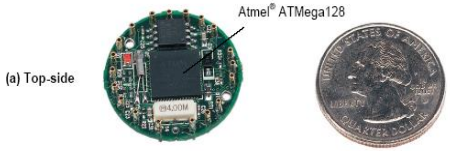
Why should I study Operating Systems?

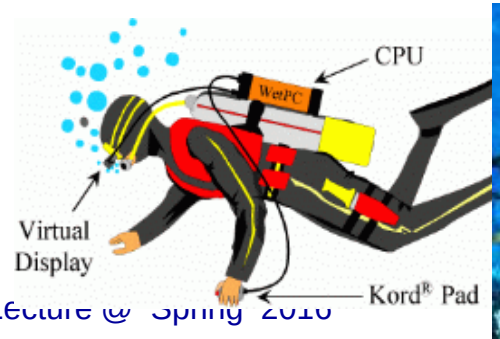
- Need to understand interaction between the hardware and applications
  - New applications, new hardware.
  - Inherent aspect of society today
- Need to understand basic principles in the design of computer systems
  - efficient resource management, security, flexibility
- Increasing need for specialized operating systems
  - e.g. embedded operating systems for devices - cell phones, sensors and controllers
  - real-time operating systems – vehicles, aircraft control, multimedia services

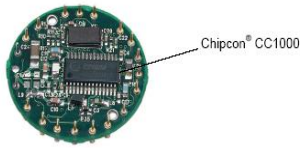
Source: from ICS 143, Prof. Venkat

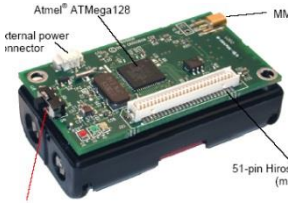
Systems Today and The Future

Source: from ICS 143, Prof. Venkat





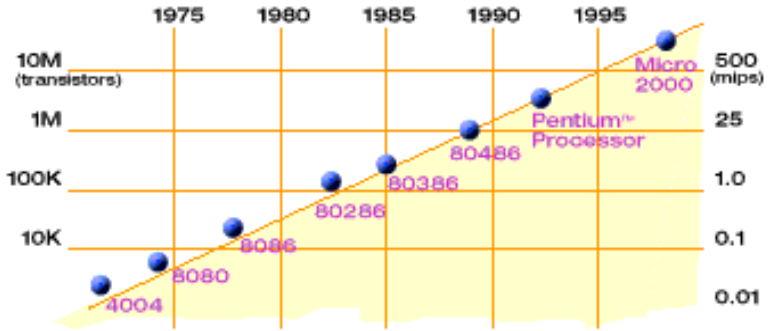


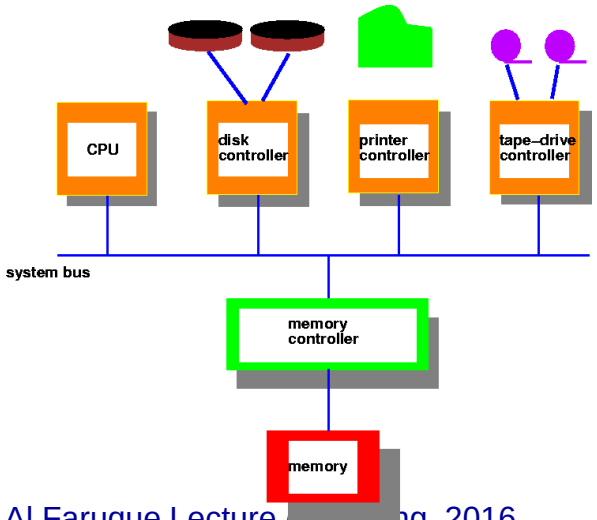


Irvine Sensorium

Hardware Complexity Increases

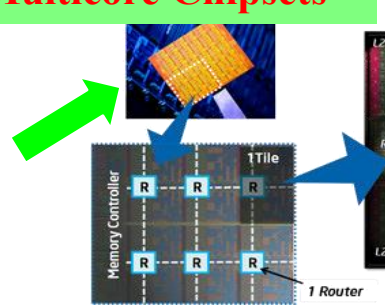
Source: from ICS 143, Prof. Venkat

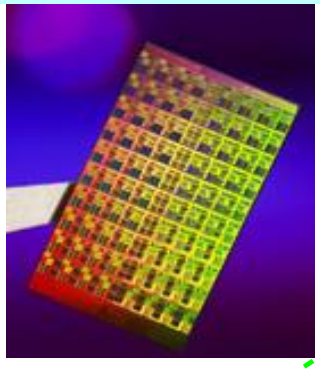


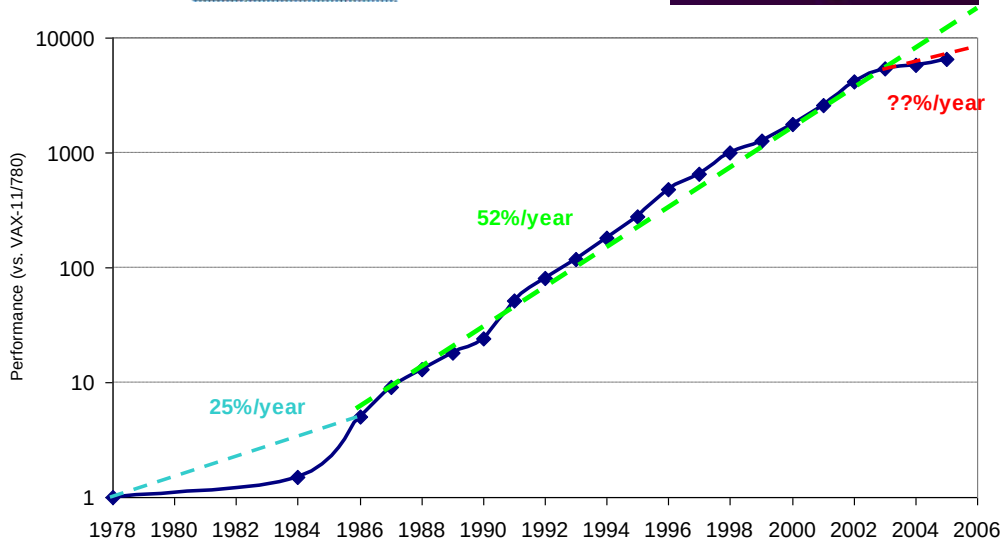


From Berkeley OS course

Intel Multicore Chipsets

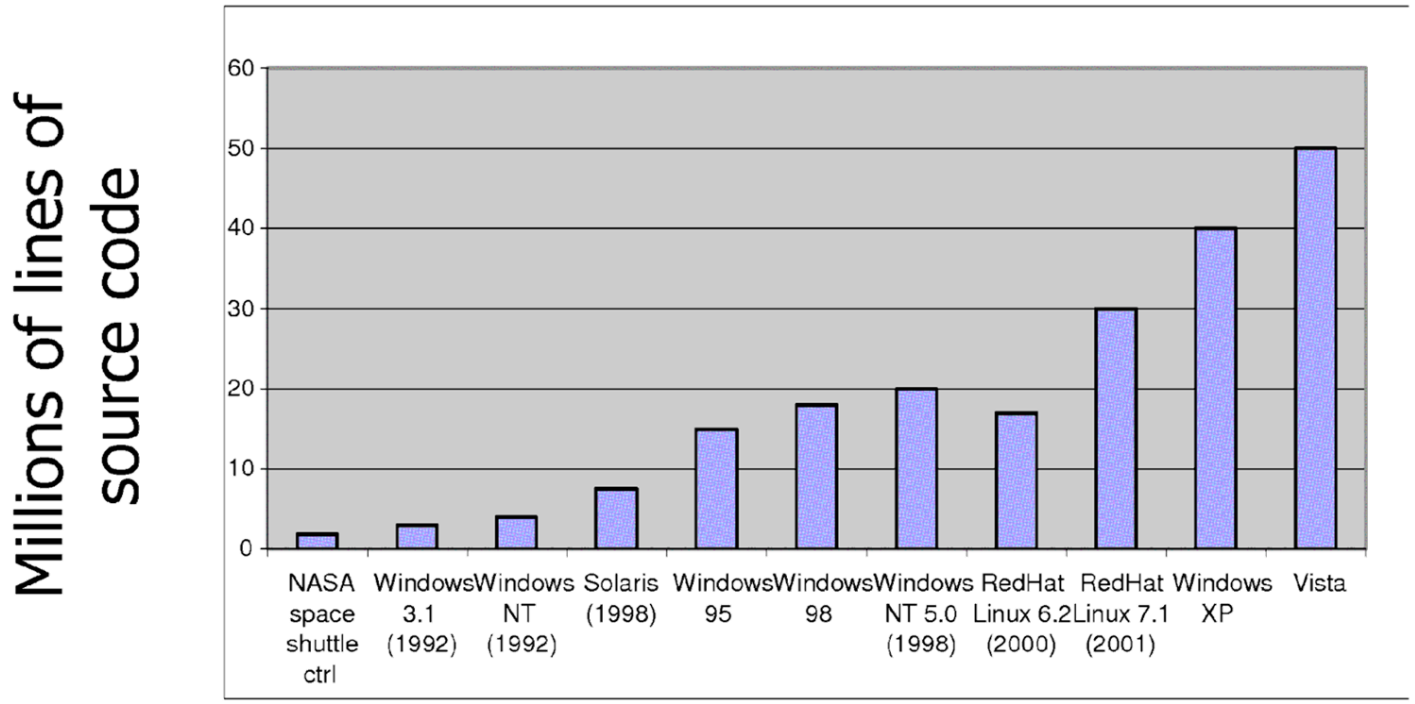






From Hennessy and Patterson, *Computer Architecture: A Quantitative Approach*, 4th edition, Sept. 15, 2006

Software Complexity Increases

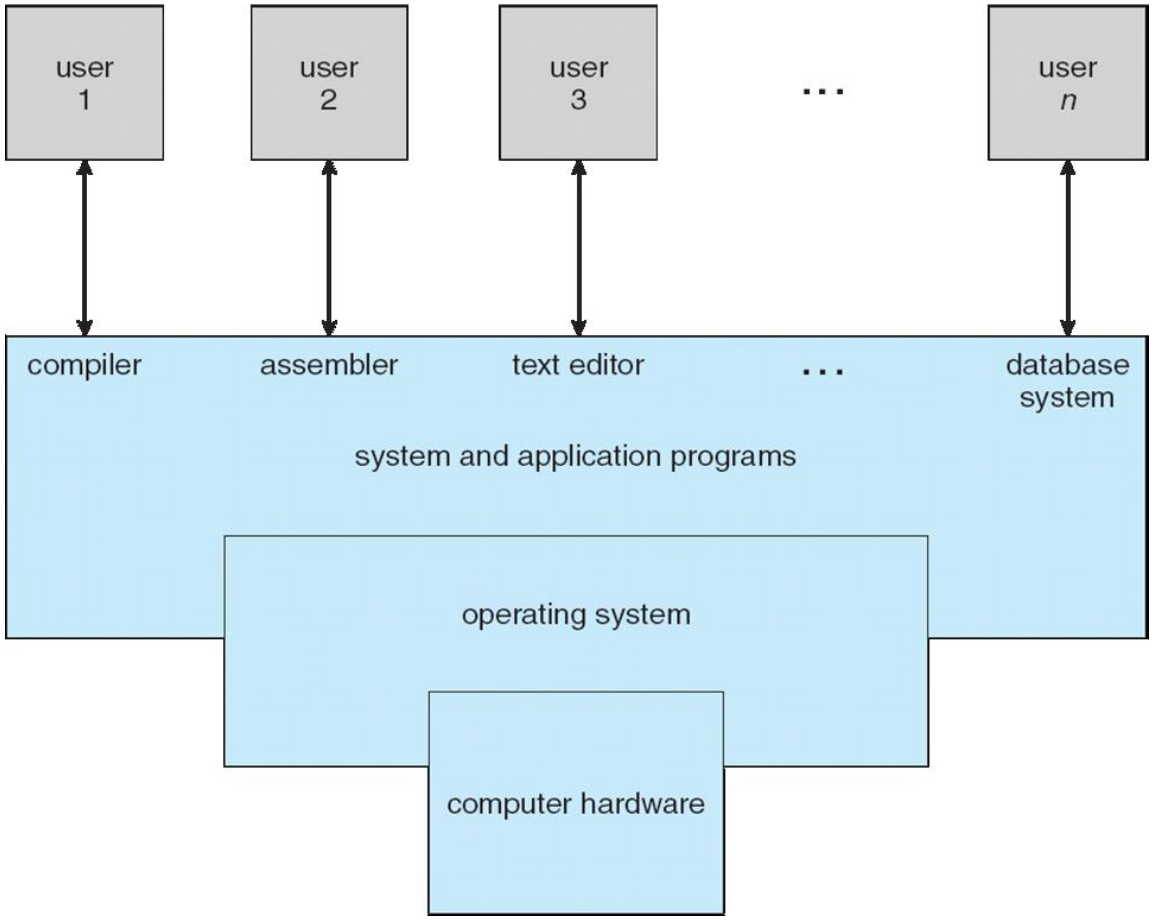


From MIT's 6.033 course

Computer System Structure

- **Computer system can be divided into four components:**
  - **Hardware – provides basic computing resources**
    - CPU, memory, I/O devices
  - **Operating system**
    - Controls and coordinates use of hardware among various applications and users
  - **Application programs – define the ways in which the system resources are used to solve the computing problems of the users**
    - Word processors, compilers, web browsers, database systems, video games
  - **Users**
    - People, machines, other computers

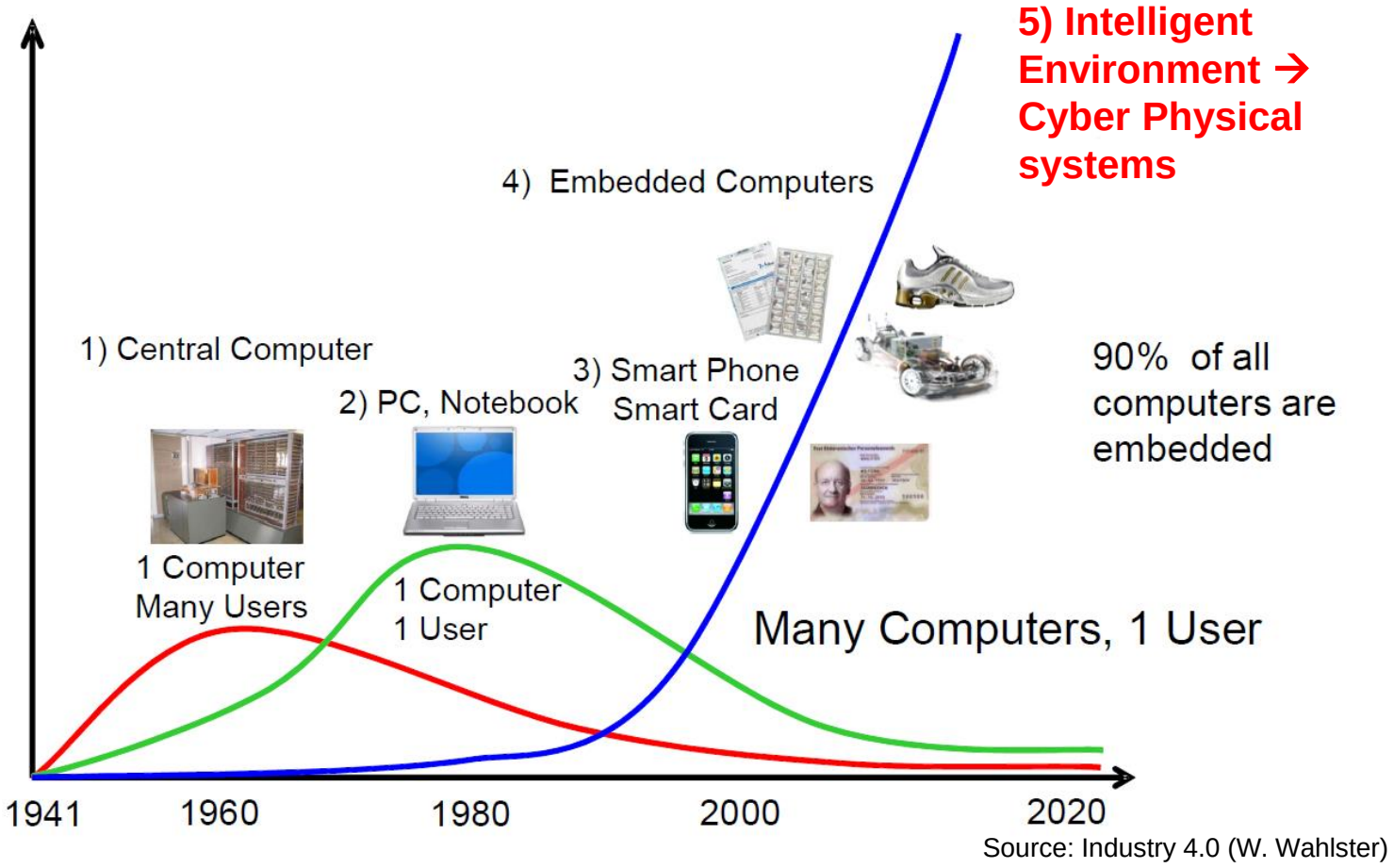
Four Components of a Computer System



What Operating Systems Do

- Depends on the point of view
- Users want convenience, ease of use
  - Don't care about resource utilization
- But shared computer such as mainframe or minicomputer must keep all users happy
- Users of dedicate systems such as workstations have dedicated resources but frequently use shared resources from servers
- Handheld computers are resource poor, optimized for usability and battery life
- Some computers have little or no user interface, such as embedded computers in devices and automobiles

Computing System Paradigm



Source: Industry 4.0 (W. Wahlster)

Operating System Definition

- OS is a resource allocator
  - Manages all resources
  - Decides between conflicting requests for efficient and fair resource use
- OS is a control program
  - Controls execution of programs to prevent errors and improper use of the computer
- Kernel "The one program running at all times on the computer" is the kernel.

Computer Startup

- **Bootstrap program is loaded at power-up or reboot**
  - **Typically stored in ROM or EPROM, generally known as firmware**
  - **Initializes all aspects of system**
  - **Loads operating system kernel and starts execution**

How many of you have used Linux or Unix before?

References

Part of the contents of this lecture has been adapted from the book Abraham Silberschatz, Peter B. Galvin, Greg Gagne: "Operating System Concept ", Publisher : Wiley; 9 edition (December 17, 2012), ISBN-13: 978-1118063330

Slides also contain lecture materials from John Kubiatowicz (Berkeley), John Ousterhout (Stanford), Nalini (UCI), Rainer (UCI), and others

Some slides adapted from http://www-inst.eecs.berkeley.edu/~cs162/ Copyright © 2010 UCB

Thank you for your attention