

Lecture 2:

Introduction to Computers, the Internet and The World Wide Web

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1.2 Computers: Hardware and Software

- A **computer** is a device that can perform computations and make logical decisions billions of times faster than human beings can.
- Today's fastest **supercomputers** can perform thousands of trillions (quadrillions) of instructions per second!
- Computers process **data** under the control of sets of instructions called **computer programs**.
- Programs guide the computer through orderly sets of actions specified by people called **computer programmers**.
- A computer consists of various devices referred to as hardware.
- The programs that run on a computer are referred to as software.

1.3 Computer Organization

- Virtually every computer may be envisioned as divided into six **logical units** or sections:
 - **Input unit.** This “receiving” section obtains from **input devices** and places it at the disposal of the other units so that it can be processed.
 - **Output unit.** This “shipping” section takes information that the computer has processed and places it on various **output devices** to make it available for use outside the computer.
 - **Memory unit.** This rapid-access, relatively low-capacity “warehouse” section retains information that has been entered through the input unit, making it immediately available for processing when needed. It also retains processed information until it can be placed on output devices by the output unit. Information in the memory unit is **volatile**. The memory unit is often called either **memory** or **primary memory**.

1.3 Computer Organization (cont.)

- **Arithmetic and logic unit (ALU)**. This “manufacturing” section performs calculations. It also contains the computer’s decision mechanisms. In today’s systems, the ALU is usually implemented as part of the next logical unit, the CPU.
- **Central processing unit (CPU)**. This “administrative” section coordinates and supervises the operation of the other sections.
 - Tells the input unit when information should be read into the memory unit
 - Tells the ALU when information from the memory unit should be used in calculations
 - Tells the output unit when to send information from the memory unit to certain output devices.
 - Many of today’s computers have multiple CPUs and, hence, can perform many operations simultaneously—such computers are called **multiprocessors**. A **multi-core processor** implements multiprocessing on a single integrated circuit chip.

1.3 Computer Organization (cont.)

- **Secondary storage unit.** This is the long-term, high-capacity “warehousing” section. Programs or data not actively being used by the other units normally are placed on secondary storage devices (e.g., your hard drive) until they’re again needed, possibly hours, days, months or even years later. Therefore, information on secondary storage devices is said to be **persistent**.

1.4 Personal, Distributed and Client/Server Computing

- In 1977, Apple Computer popularized **personal computing**.
- In 1981, IBM, the world's largest computer vendor, introduced the IBM Personal Computer (PC).
 - This quickly legitimized personal computing in business, industry and government organizations, where IBM mainframes were heavily used.
- Machines could be linked together in computer networks, sometimes over telephone lines and sometimes in **local area networks (LANs)** within an organization.
 - Led to the phenomenon of **distributed computing**, in which an organization's computing is distributed over networks to the sites where the organization's work is performed.

1.4 Personal, Distributed and Client/Server Computing (cont.)

- Today's personal million-dollar machines
- Information is shared over networks, where common data stores and computers distribute the term **client/server**
- C++ has become an operating system for distributed client/server applications.



1.5 The Internet and the World Wide Web

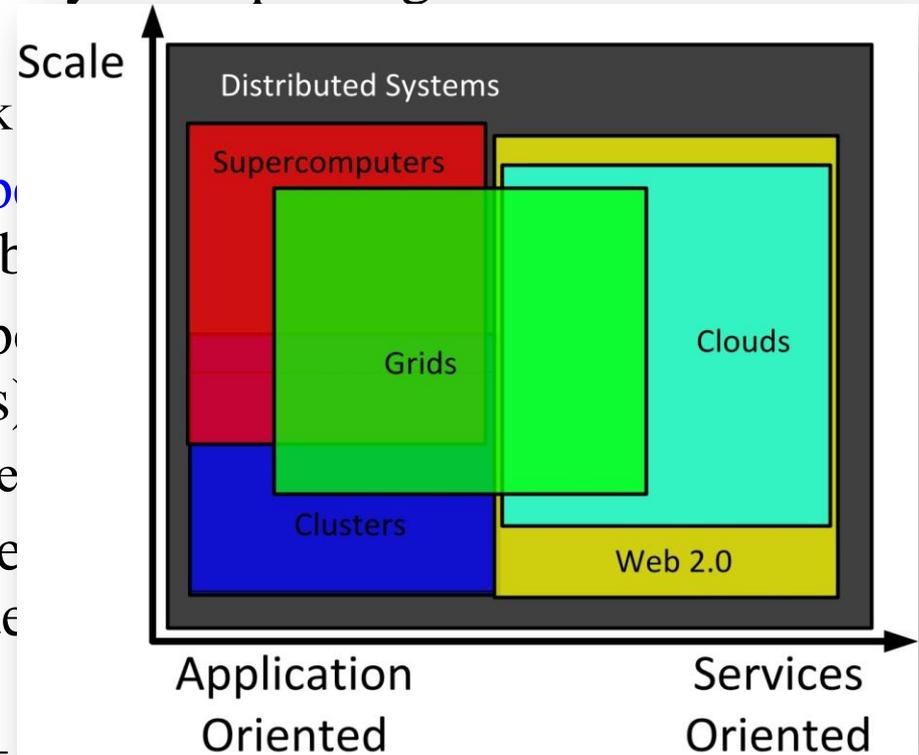
- The **Internet** was initiated in the late 1960s with funding supplied by the U.S. Department of Defense.
- Originally designed to connect the main computer systems of about a dozen universities and research organizations.
- With the introduction of the **World Wide Web**, the Internet has exploded into the world's premier communication mechanism.
- The Internet and the World Wide Web are surely among humankind's most important and profound creations.

1.6 Web 2.0

- **Web 2.0** has no single definition but can be explained through a series of Internet trends, one being the empowerment of the user.
- Companies are built almost entirely on **community-generated content**.
- Takes advantage of **collective intelligence**
 - the idea that collaboration will result in intelligent ideas.
 - Example: **wikis**, such as the encyclopedia Wikipedia, allow users access to edit content.
- **Tagging**, or labeling content, is another key part of the collaborative theme of Web 2.0
 - seen in sites such as Flickr and del.icio.us.
- **Social networking** sites have experienced extraordinary growth as part of Web 2.0.
 - Rely heavily on **network effects**, attracting users only if their friends or colleagues are also members.

1.6 Web 2.0 (cont.)

- Social media sites have gained immense popularity, partly due to the increased availability of **broadband Internet**, often referred to as high-speed Internet.
- **Blogs**—websites characterized by short postings in reverse chronological order.
 - **blogosphere** often used to track
- The increased popularity of **open source** software has made it cheaper and easier to start Web 2.0 applications.
- **Web services**—software components (or other software components) that can be accessed over the Internet.
 - Favoring the “**webtop**” over the desktop.
- **Mashups** combine two or more existing web services for a new purpose and are dependent on the services they combine.



1.7 Machine Languages, Assembly Languages and High-Level Languages

- Programmers write instructions in various programming languages, some directly understandable by computers and others requiring intermediate **translation** steps.
- Computer languages may be divided into three general types:
 - Machine languages
 - Assembly languages
 - High-level languages
- Any computer can directly understand only its own **machine language**.
 - The “natural language” of a computer and as such is defined by its hardware design.
- Machine languages are **machine dependent**.
 - Too slow (for development), tedious and error prone for most programmers.

1.7 Machine Languages, Assembly Languages and High-Level Languages (cont.)

- English-like abbreviations that represent elementary operations formed the basis of **assembly languages**.
- **Translator programs** called **assemblers** convert assembly-language programs to machine language.
- Programmers still had to use many instructions to accomplish even the simplest tasks.
- To speed the programming process, **high-level languages** were developed in which single statements could be written to accomplish substantial tasks.
- Translator programs called **compilers** convert high-level language programs into machine language.
- **Interpreter** programs execute high-level language programs directly (without the delay of compilation), although slower than compiled programs run.

1.8 History of C and C++

- C++ evolved from C, which evolved from two previous programming languages, BCPL and B.
- BCPL was developed in 1967 by Martin Richards as a language for writing operating systems software and compilers for operating systems.
- Ken Thompson modeled many features in B after their counterparts in BCPL and used B to create early versions of the UNIX operating system at Bell Laboratories in 1970.
- The C language was evolved from B by Dennis Ritchie at Bell Laboratories.
 - C initially became widely known as the development language of the UNIX operating system.
 - Today, most operating systems are written in C and/or C++.
 - C is available for most computers and is hardware independent.
 - It's possible to write C programs that are **portable** to most computers.

1.8 History of C and C++ (cont.)

- C++, an extension of C, was developed by Bjarne Stroustrup in the early 1980s at Bell Laboratories.
- C++ provides capabilities for **object-oriented programming**.
- **Objects** are essentially reusable software **components** that model items in the real world.
- Modular, object-oriented design and implementation makes programmers much more productive than can previous popular programming techniques.
- Object-oriented programs are easier to understand, correct and modify.

1.9 C++ Standard Library

- C++ programs consist of pieces called **classes** and **functions**.
- Most C++ programmers take advantage of the rich collections of classes and functions in the **C++ Standard Library**.
- Two parts to learning the C++ “world.”
 - The C++ language itself, and
 - How to use the classes and functions in the C++ Standard Library.
- Many special-purpose class libraries are supplied by independent software vendors.

1.10 History of Java

- Microprocessors are having a profound impact in intelligent consumer electronic devices.
- Recognizing this, Sun Microsystems in 1991 funded an internal corporate research project code-named Green.
- Resulted in the development of a C++-based language called Java
 - Created by James Gosling.
- The World Wide Web exploded in popularity in 1993, and Sun saw the immediate potential of using Java to add **dynamic content** to web pages.
- Java garnered the attention of the business community because of the phenomenal interest in the World Wide Web.
- Java is now used to develop large-scale enterprise applications, to enhance the functionality of web servers, to provide applications for consumer devices and for many other purposes.

1.11 Fortran, COBOL, Pascal and Ada

- **FORTRAN** (FORmula TRANslator) was developed by IBM Corporation in the mid-1950s to be used for scientific and engineering applications that require complex mathematical computations.
 - Still widely used in engineering applications.
- **COBOL** (COmmon Business Oriented Language) was developed in the late 1950s by computer manufacturers, the U.S. government and industrial computer users.
 - Used for commercial applications that require precise and efficient manipulation of large amounts of data.

1.11 Fortran, COBOL, Pascal and Ada (cont.)

- **Structured programming**—a disciplined approach to writing programs that are clearer and easier to test, debug and modify than large programs produced with previous techniques.
- **Pascal** programming language was created by Professor Niklaus Wirth in 1971.
 - Designed for teaching structured programming and rapidly became the preferred programming language in most colleges.
- The **Ada** language was developed under the sponsorship of the U.S. Department of Defense (DoD) during the 1970s and early 1980s.
 - The DoD wanted one language that would fill most of its needs.
 - One important capability of Ada, called **multitasking**, allows programmers to specify that many activities are to occur in parallel.

1.12 BASIC, Visual Basic, Visual C++, C# and .NET

- The **BASIC** (Beginner's All-purpose Symbolic Instruction Code) programming language was developed in the mid-1960s at Dartmouth College as a means of writing simple programs.
 - Primary purpose was to familiarize novices with programming techniques.
- Microsoft's Visual Basic language was introduced in the early 1990s to simplify Windows application development
 - One of the most popular programming languages.
- The **.NET platform** provides capabilities for creating and running applications that can execute on computers distributed across the Internet.
- Three primary programming languages
 - **Visual Basic** (based on the original BASIC)
 - **Visual C++** (based on C++)
 - **Visual C#** (based on C++ and Java; developed expressly for the .NET platform).

Questions

