

LECTURE 2

Introduction to computer systems

Architecture of computer systems

Plan

- **1. Review of computer systems.**
- **2. Evolution of computer systems.**
- **3. Architecture and components of computer systems.**
 - **Use of computer systems.**
 - **Data representation in computer systems.**

- **Aim of the lecture:** to discuss and give a brief idea on computer hardware.

Having studied this session the student will be able to:

- Describe what hardware is
- Classify computer hardware according to the usage of them
- Give examples for each category of computer hardware
- Identify the different ports of a PC
- Identify why your computer is slow
- Identify the factors affecting on performance of computers

REFERENCE

1. **June J. Parsons, *New Perspectives on Computer Concepts 18th Edition—Comprehensive*, Thomson Course Technology, a division of Thomson Learning. Cambridge: Cambridge University press, 2016; ISBN-10: 1-4239-0610-1.**
2. **Stephen P Borgatti, Martin G. Everett, Jeffrey C. Johnson *Analyzing Social Networks* Paperback. ISBN: 978-1446247419 – 30 Apr 2013**

Review of computer systems.

- **A computer is a general purpose device which can be programmed to carry out a finite set of arithmetic or logical operations. Since a sequence of operations can be readily changed, the computer can solve more than one kind of problem.**
- **A computer is, at its most basic, a machine which can take instructions, and perform computations based on those instructions.**
- **A computer is an electronic device which is capable of receiving the inputs (data from the user), storing it for a desired period of time, manipulating it according to the set of instructions (called program) and producing the output to the user in desired form. It performs a variety of operations in accordance to the set of instructions.**

Review of computer systems

- A computer is an electronic device that manipulates information, or "data". It has the ability to store, retrieve, and process data. You can use a computer to type documents, send email, and browse the internet. You can also use it to handle spreadsheets, accounting, database management, presentations, games, and more.
- Since the computer is a man-made digital electronic device, it has a physical structure with several parts like the monitor, processor, mouse, and key board which are tangible. These are called Hardware. The sets of instructions which are also called computer programs installed in the computer are called Software. These softwares tell the hardware what to do and how to do to accomplish some tasks expected by the user to get done by the computer.

Characteristics of a Computer

- **Speed.** A computer can perform tasks very fast. For example, the amount of work that a human being can do in an entire year (if he worked day and night and did nothing else) can be accomplished by a computer within a few minutes. As you are aware now, inside the system unit, the operations occur through electronic circuits. When data, instructions, and information flow along these circuits, they travel at close to the speed of light. This allows billions of operations to be carried out in a single second.
- **Reliability.** Electronic components in modern computers are dependable because they have a low failure rate. The high reliability of the components enables the computer to produce consistent results.

Characteristics of a Computer

- **Accuracy.** The accuracy of a computer is consistently high and the degree of accuracy of a particular computer depends upon its design. Errors can occur in a computer, but these are mainly due to human mistakes. Thus, computers can process large amounts of data and generate error-free results, provided the data is entered correctly. If inaccurate data is entered, the resulting outputs will also be incorrect. This computing principle is known as *Garbage in, garbage out (GIGO)*.
- **Diligence.** Unlike human beings, a computer is free from boredom, tiredness, lack of concentration, etc., hence a computer can work for hours without making any errors or complaints. Even if ten million calculations have to be performed, a computer will perform the ten millionth calculations with exactly the same accuracy and speed as the first one.

- **Versatility.** The computers have the capacity to perform completely different type of work. You may use your computer to prepare payroll slips at the moment. Next moment you may use it for inventory management or to prepare electric bills. The computers are flexible enough to adapt to any type of work and outputs according to what is fed and instructed.
- **Power of remembering.** Every piece of information that a user „stores“ on a computer can be retained as long as it is needed and can be recalled when necessary. Even after several years, the information recalled would be identical to what was fed to the computer. A computer will never „lose“ stored information on its own; a user has to „remove“ (or delete) the information from it.
- **No Feeling.** Computers do not have emotions. They have no feelings and no instincts because they are machines. Although human beings have succeeded in building a memory for the computer, a computer does not possess the equivalent of a human brain. Based on our feelings, taste, knowledge and experience, we often make certain judgments in our day-to-day life, but computers cannot make such judgments on their own. Their judgment is based on the instructions given to them in the form of programs by someone.

- **No IQ.** Computer is a dumb machine and it cannot do any work without instruction from the user. It performs the instructions at wonderful speed and with accuracy. It is you to decide what you want to do and in what sequence. So a computer cannot take its own decision as you can.
- **Storage.** The computer has an in-built memory where it can store a large amount of data. This is called Primary Storage. This Primary Storage has a limited capacity but it is very important as the processing unit of the computer can act directly only on instructions and data on the primary storage. But, you can also store data in secondary storage devices such as floppies, which can be kept outside your computer and can be carried to other computers. These are called Secondary Storage. Before the computer can process the data stored in Secondary storage devices, the data must be moved from secondary storage device to primary storage. This is not a serious drawback. The computers can retrieve information from files in a secondary storage device in a few milliseconds.

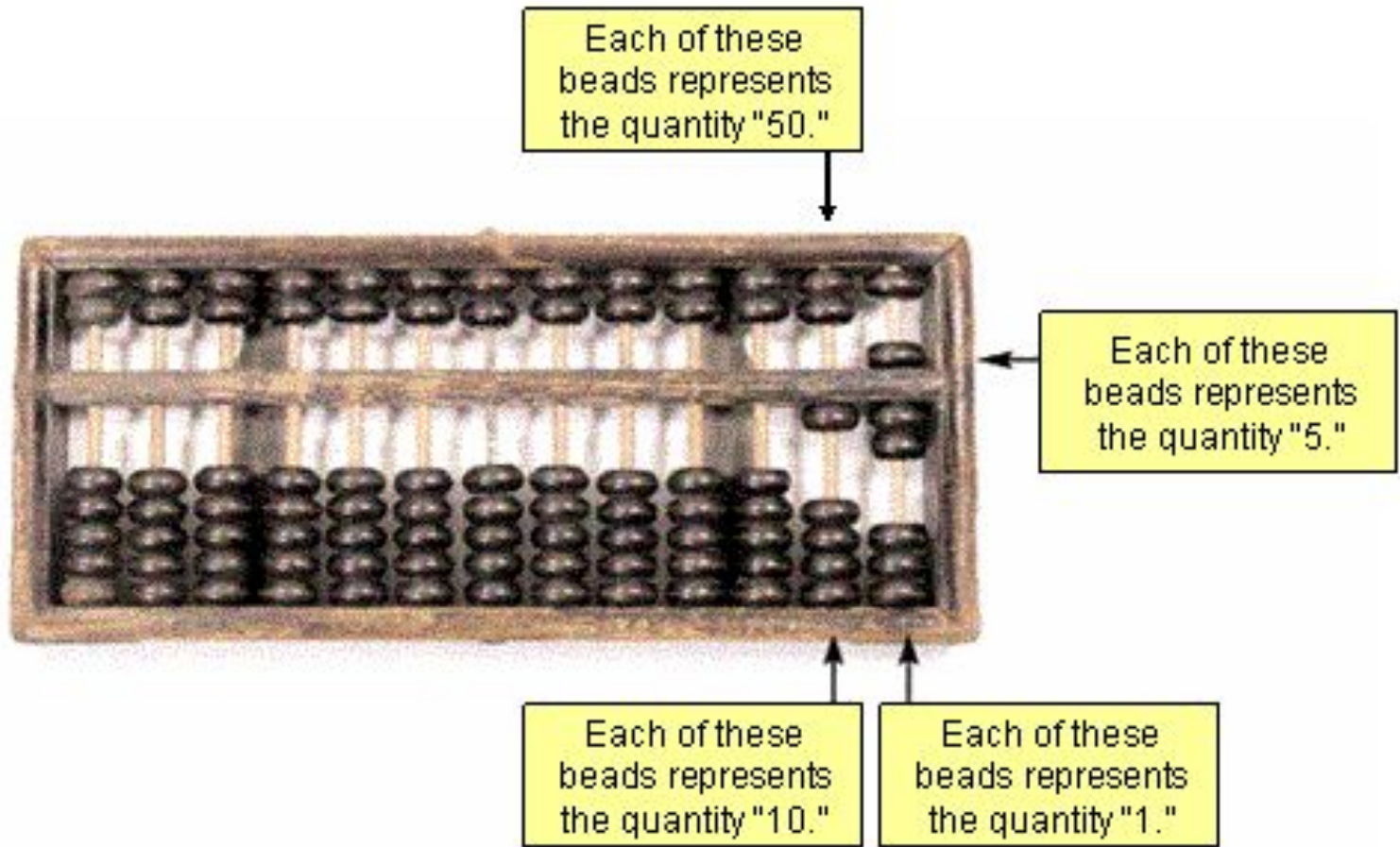
Evolution of computer systems

- **Microcomputers:** most common type of computers in the society. Can be used at your workplace, at school or on your study desk at home. Used by single user at a time. Small in size. Also called Personal Computers (PCs): Desktop PCs, Laptop, Netbook, Tablets.
- **Minicomputers:** used by multi-users. In the middle when the computers are ranged from smallest to largest. Used in laboratories.
- **Mainframes:** Largest in size. Capable of handling and processing very large amounts of data quickly.
- **Super computers:** Used for performing complex scientific and numerical computations such as weather forecasting, fluid dynamics, nuclear simulations, theoretical astrophysics.

- **Hardware.** The tangible parts that make up the computer are called „Hardware“. The physical parts such as monitor, keyboard, processor, and speakers can be identified as hardware. We can use the generic term device to refer any piece of hardware. You will learn deeply about computer hardware in Session 03 of this course material.
- **Software.** Computer software is a set of instructions that tells computer hardware what to do. The computer will work according to the instructions given to it. We can use the generic term computer program to refer any piece of software. Some software are specially designed for the primary functions of the computer to manage its operations while some software are designed for the users to get their work done, ex. to prepare a letter. However, software can be categorized into different categories and you will learn deeply about software in Session 04 of this course material.
- **Data.** Any individual fact or piece of information in a form suitable for use with a computer is known as „data“. This information may be in the form of text, documents, images, audio clips or software program. The primary use of the computer is to convert these data into useful information to the user. The computer accepts data from some sources or from the user to produce useful information. Thus the raw data fed into the computer may not make much sense to the users until it is processed.

2. Evo luti on

- **of** Needed calculation devices to keep track of accounting for commerce
- **Computer** 1200s—Manual Calculating Devices: the *abacus*



Evolution of Computers (continued)

◦ **1600s—Mechanical Calculators**

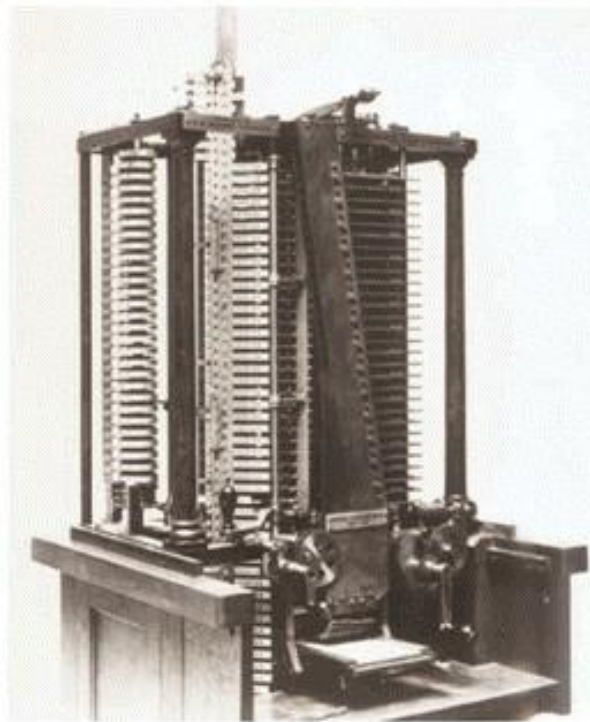
- **Used wheels, gears, and counters**
- **To work a mechanical calculator, the operator enters the numbers for a calculation, and then pulls a lever or turns a wheel to carry out the calculation**
- **Example: the Pascaline invented by Blaise Pascal. It used some principles of the abacus, but used wheels to move counters.**

◦ 1800s—Punched Cards

- Used holes following a specific pattern to represent the instructions given to the machine or stored data
- Different program instructions can be stored on separate punched cards, which can be fed through the computing machine repeatedly.
- Once punched, the cards were fed into a card reader that used an array of metal rods to electronically read the data from the cards and tabulate the results. This is called the *Hollerith Tabulating Machine*
- Hollerith incorporated *The Tabulating Machine* better known today as *IBM*.

◦ **Charles Babbage designed a new general-purpose calculating device, the *Analytical Engine*, which is the ancestor of modern computers.**

- **It included the essential components of present-day computers, which are input, process, storage, and output of data.**



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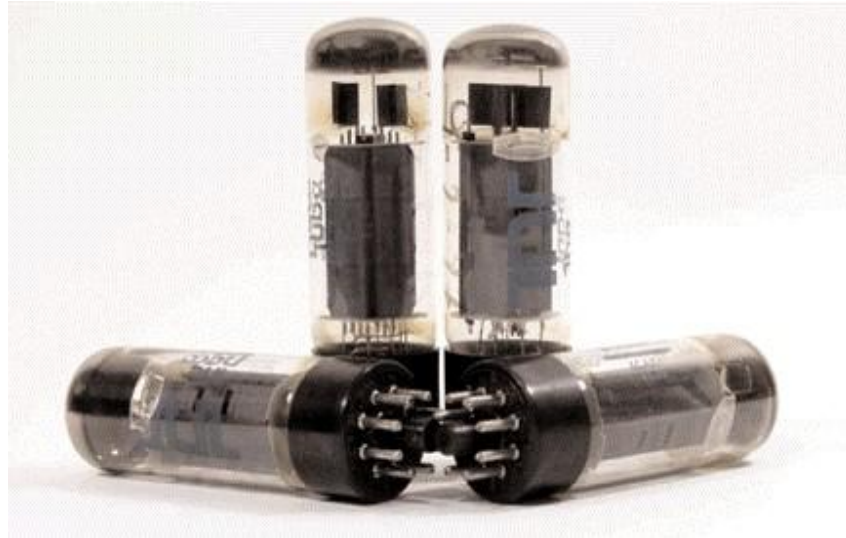
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◦ **1940s—Vacuum Tubes**

• Used to control the flow of electrons. Since vacuum tubes responded faster than mechanical components, faster computations were possible. But, the tubes consumed a lot of power and burned out quickly.

• The first computer prototype using vacuum tubes was ENIAC (Electronic Numerical Integrator and Computer). It was designed to calculate trajectory tables for the U.S. Army during World War II, but it was not completed until three months after the war.



° 1950s—Transistors

- Smaller, cheaper, more reliable, and consumed less power than vacuum tubes.
- Could perform 200,000 to 250,000 calculations per second.

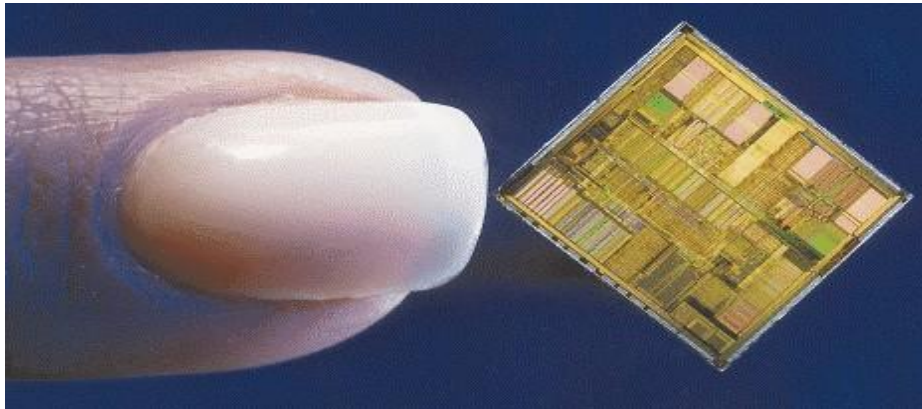


◦ **1960s—Integrated Circuits**

- **Thin slice of silicon packed with microscopic circuit elements such as wire, transistors, capacitors, and resistors.**
- **Enabled the equivalent of thousands of vacuum tubes or transistors to be packed onto a single miniature chip about the size of your fingernail**
- **Reduces the physical size, weight, and power requirements for devices such as computers**

° 1970s to Present—Microprocessor

- Combined components of a computer on a microchip
- Can be manufactured and then programmed for various purposes



Moore's Law

° Law can be stated as:

Number of transistors on a microchip doubles every 18 months.

° Predictions based on Moore's Law

- Processing power (speed) doubles every 18 months.
- Storage capacity of RAM increases exponentially.

App licat ions of

◦ In Education

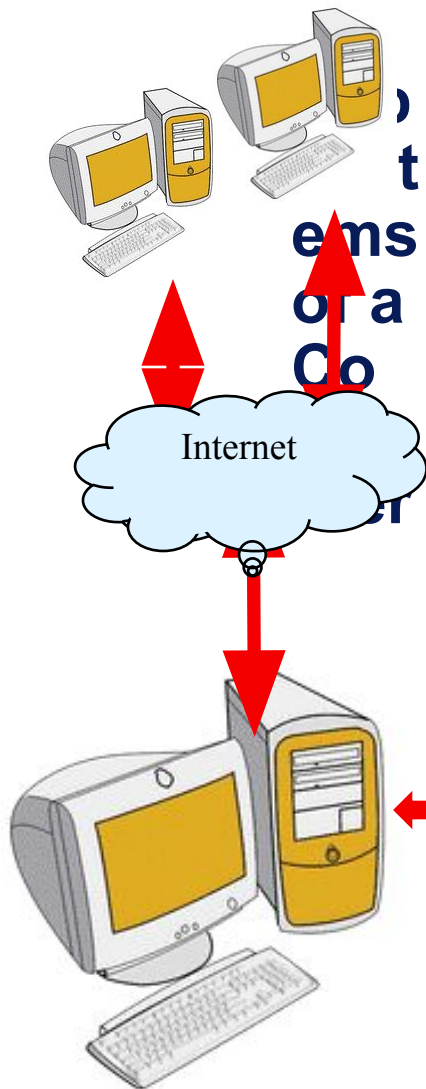
- Multimedia-Facilitated Learning
- Simulation-Based Education
- Intelligent Machine-Based Training
- Interactive Learning

◦ In Business

- Supply Chain Management
- Project Management
- Customer Relationship Management
- Sales and Marketing Using Electronic Commerce
- Manufacturing Research

3. Components of a Computer System

- Hardware System
- Software System—Operating System
Software and Application Software
- Network System



Hardware System

- Keyboard
- Monitor
- System unit

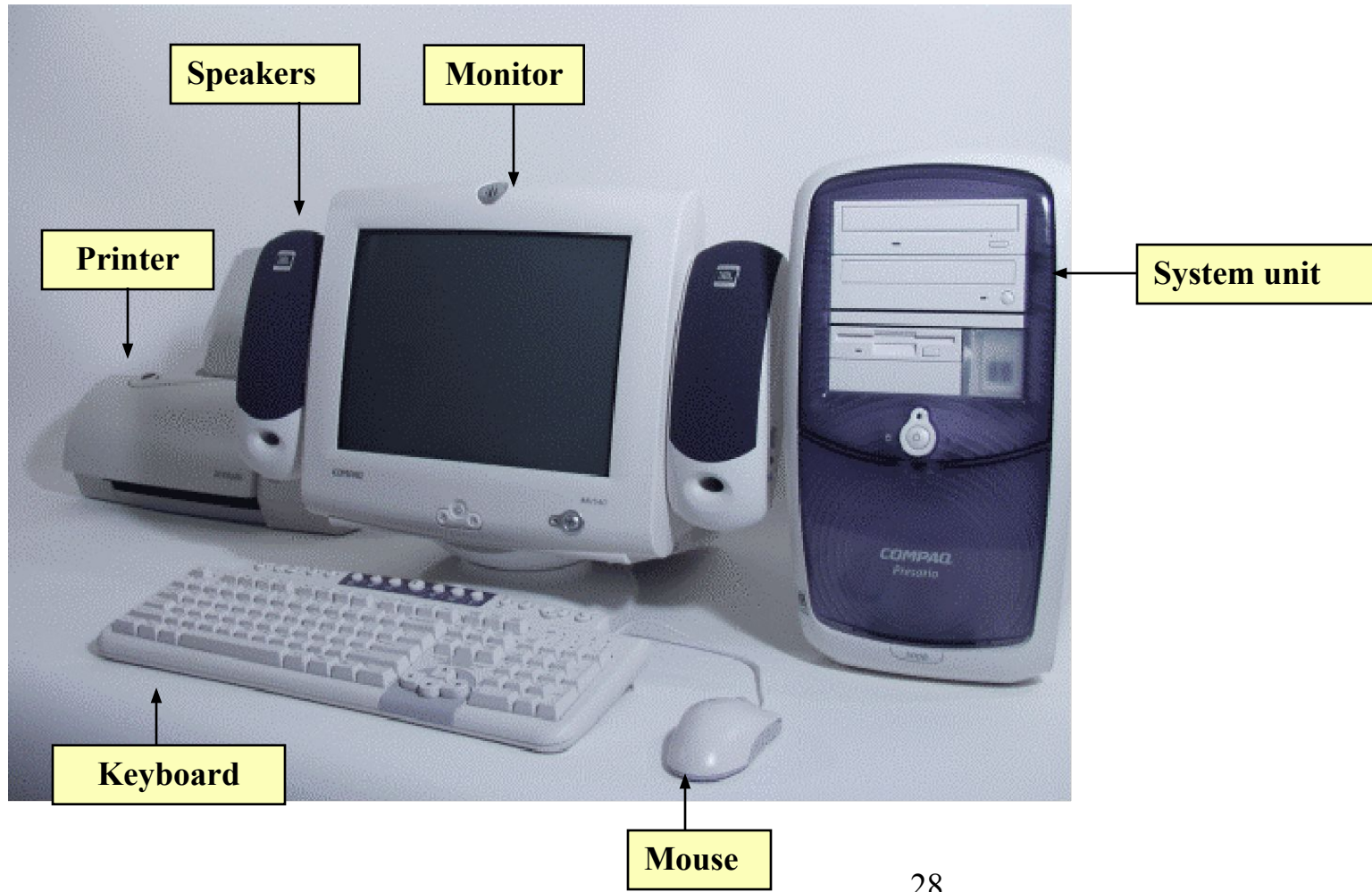
Network System

- Internet services (email)
- Network connections (modems, network cards)

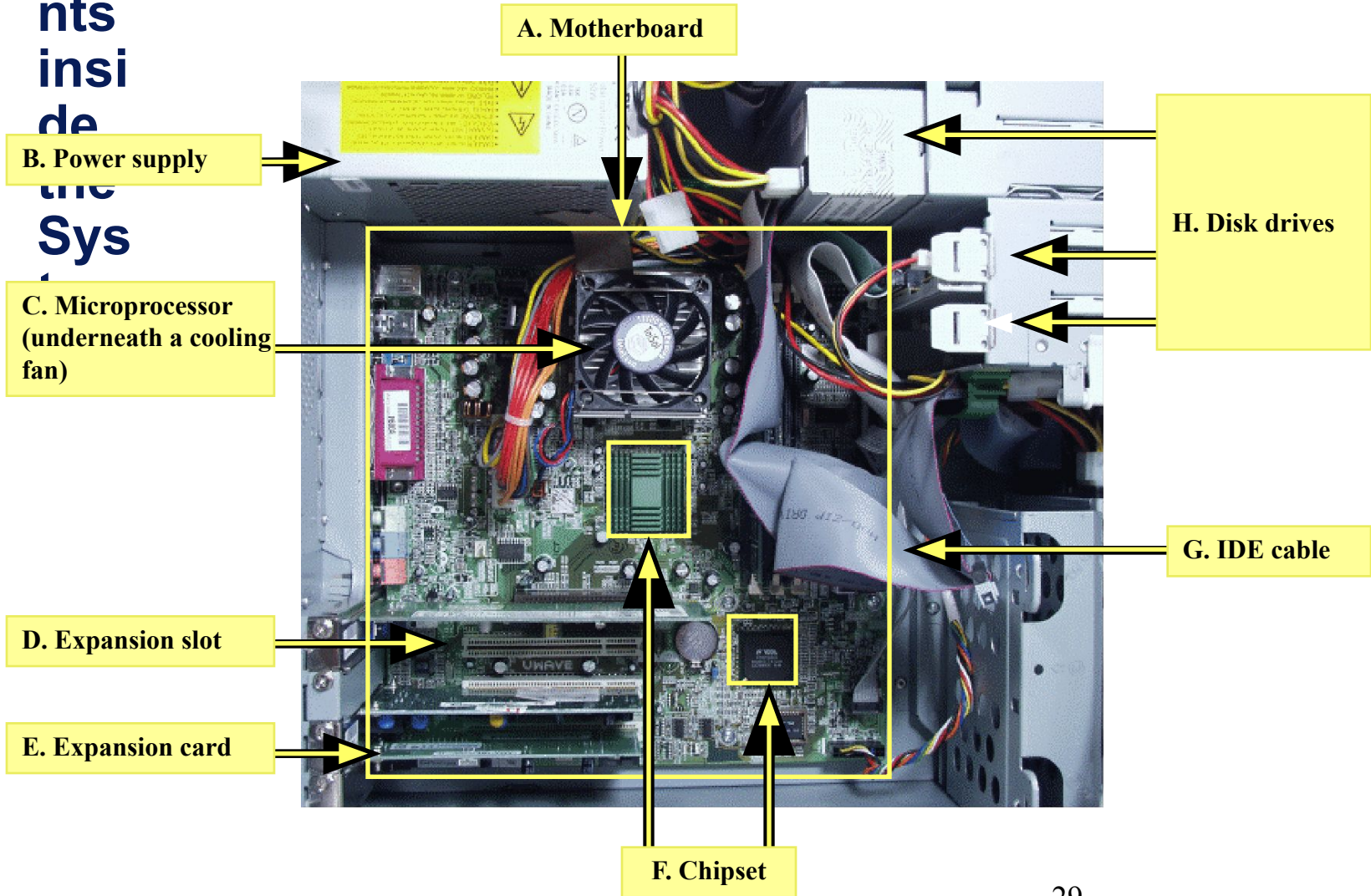
Software System

- Operating System (Unix, Mac OS, Microsoft Windows)
- Web browser (Firefox, Internet Explorer)
- Office productivity applications (Microsoft Office, Star Office)

Hardware System



Components inside the System

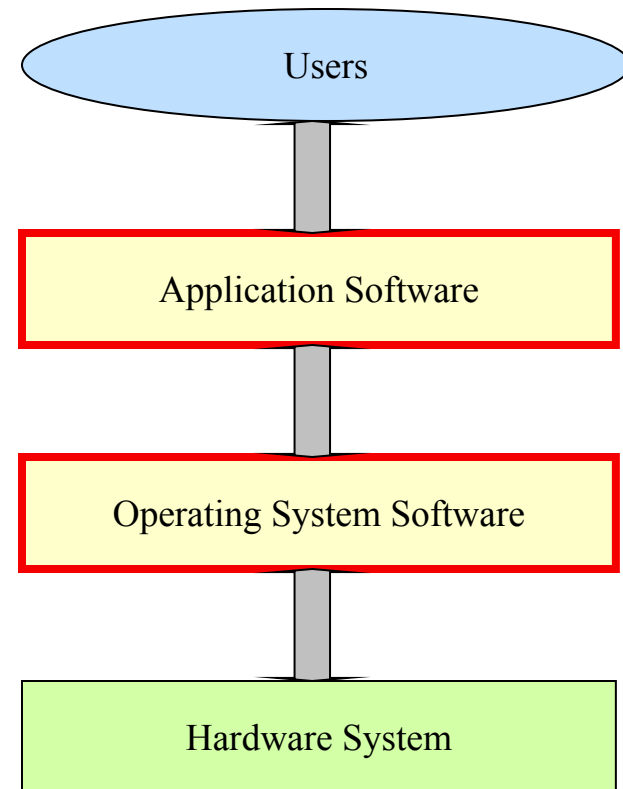


Wh
at is
Soft

- **Software is a set of computer instructions or data.**
- **Software receives input from the user and processes this input through the computer to produce output.**
- **Software directs how the computer interacts with the user.**
- **Software specifies how to process the user's data**

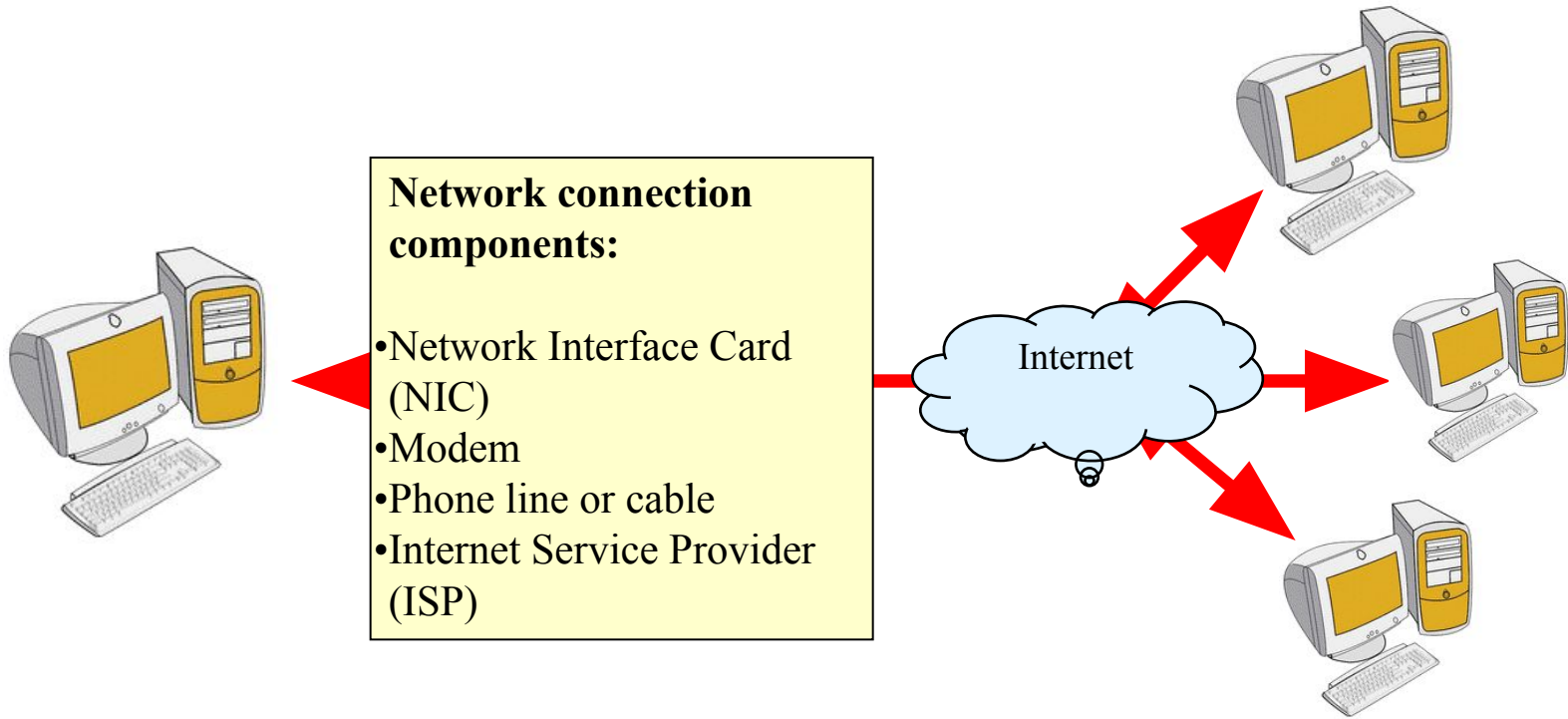
Soft war e Sys tem

- **Two categories: operating system (OS) software and application software.**
- ***Operating system software*, also called system software, is the master controller for all activities that take place within a computer**
 - **Examples of OS software:**
 - **Microsoft Windows, Unix, Mac OS**
- ***Application software* is a set of one or more computer programs that helps a person carry out a task**
 - **Examples of application software:**
 - **Microsoft Word**
 - **Internet Explorer**
 - **Macromedia Dreamweaver**
 - **Adobe Acrobat Reader**



Network System

- A network provides connections among computers to enable computers on a network to share data (e.g. documents), hardware (e.g. printers), and software resources (e.g. application programs).
- Network users can also send messages to each other.
- A network must be secured to protect data from unauthorized usage (e.g. using login name and password to gain access to a network).



Control questions

- **Why does a computer need memory?**
- **What is the best type of storage for my data?**
- **What factors affect a computer's screen display?**
- **Are ink jet printers better than laser printers?**
- **What's the best way to add devices to a computer system?**
- **How can I protect my computer system from theft and damage?**