



**Al-Mustaqbal University / College of Technical Engineering**  
**Department (Department of Cybersecurity Techniques Engineering)**  
**Class (First)**  
**Ethics for the Information Age/ Code -UOMU0208025**  
**Lecturer (Msc. Heba Hussien)**

**2<sup>nd</sup> term – Lecture 1 Introduction to computing**

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# Lecture 1

## Introduction to Computing



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## **Lecture Objectives**

By the end of this lecture, students should be able to:

1. Understand the historical development of computers.
2. Identify the main stages of computing evolution.
3. Explain how computing has influenced modern technology.
4. Recognize the relationship between computing and cybersecurity.

## **1. What is Computing?**

Computing refers to the use of computers and digital technology to process data and produce useful information. It encompasses a broad range of activities that involve the manipulation, storage, and transmission of data through electronic systems. Computing has become the backbone of virtually every industry, from healthcare and finance to entertainment and education, fundamentally transforming how we work, communicate, and live.

### **Computing includes:**

1. Computer hardware: The physical components of computing systems, including processors, memory, storage devices, and input/output peripherals.
2. Software systems: The programs and applications that direct hardware to perform specific tasks, from operating systems to specialized applications.
3. Data processing: The transformation of raw data into meaningful information through computational operations and algorithms.
4. Computer networks: The infrastructure that connects computers and enables communication and resource sharing across distances.

### **Computing is the foundation of modern technologies such as:**

1. Artificial Intelligence: Systems that can learn, reason, and make decisions, powering applications from virtual assistants to autonomous vehicles.
2. Cloud Computing: The delivery of computing services over the internet, enabling scalable and flexible access to resources without local infrastructure.
3. Cybersecurity: The practice of protecting systems, networks, and data from digital attacks and unauthorized access.

## **2. Historical Development of Computers**

The development of computers passed through several important stages. Each stage represents a significant advancement in technology that built upon previous innovations, ultimately leading to the powerful and ubiquitous computing devices we rely on today. Understanding this evolution helps us appreciate the rapid pace of technological progress and anticipate future developments.



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### 2.1 Mechanical Calculators

The earliest computing devices were mechanical calculators developed in the 17th century. These ingenious machines represented humanity's first attempts to automate mathematical calculations, reducing human error and increasing computational speed. While primitive by modern standards, these devices established fundamental principles that would later inform electronic computing.

Example:

Pascaline (1642) invented by Blaise Pascal, a French mathematician and philosopher. This groundbreaking device used a system of gears and wheels to perform calculations automatically, demonstrating that machines could handle mathematical operations previously requiring human effort.

Functions:

1. Addition: The device could add numbers directly through the rotation of its gear mechanisms.
2. Subtraction: Through a complement method, the Pascaline could also perform subtraction operations.

Importance:

*The beginning of automated calculation. This invention marked a pivotal moment in the history of computing, proving that mechanical devices could reliably perform mathematical operations and laying the groundwork for future computing machines.*

### 2.2 Punched Card Systems

Punched cards were used to store and process data. This technology represented a major advancement in data handling, allowing information to be recorded, stored, and processed in ways that were previously impossible. The punched card system became a foundational technology for early computing and data processing industries.

**They were widely used in:**

1. Population census: Governments used punched cards to efficiently process large amounts of demographic data, dramatically reducing the time required for census tabulation.
2. Early data processing systems: Businesses and organizations adopted punched card technology for accounting, inventory management, and other administrative tasks.



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Example:

Hollerith Tabulating Machine, invented by Herman Hollerith in the late 19th century. This machine used punched cards to automatically tabulate and sort data, revolutionizing the processing of statistical information and eventually leading to the formation of IBM.

Impact:

*Early method for data input and storage. The punched card system established principles of data encoding and machine-readable information that would influence computing for decades to come.*

### 2.3 First Commercial Computers

Early commercial computers appeared in the 1950s, marking the transition from experimental machines to practical business tools. These computers, though enormous by today's standards, represented a revolutionary leap in processing capability and established the commercial computing industry.

Example:

UNIVAC (Universal Automatic Computer), the first commercially produced electronic computer in the United States. UNIVAC gained public fame when it correctly predicted the outcome of the 1952 U.S. presidential election, demonstrating the practical potential of computers to a wide audience.

Characteristics:

1. **Very large size:** These early computers occupied entire rooms, requiring dedicated facilities and specialized environmental controls.
2. **Limited processing speed:** While revolutionary for their time, these machines processed data at speeds that would be considered extremely slow by modern standards.
3. **Used by governments and large organizations:** The high cost and complexity of these systems limited their use to entities with substantial resources and significant computational needs.

### 2.4 Microprocessors

The microprocessor was developed in the 1970s, representing one of the most significant technological breakthroughs in computing history. This innovation condensed the processing power that previously required room-sized machines into a tiny chip, fundamentally changing the economics and applications of computing.



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Definition:

A microprocessor is a small integrated circuit that performs all processing operations in a computer. This single chip contains millions or billions of transistors that execute instructions, manage data, and coordinate the operations of the entire computer system.

Example:

Intel 4004, released in 1971, was the first commercially available microprocessor. Originally designed for a calculator, this groundbreaking chip demonstrated the viability of single-chip processors and opened the door to the personal computer revolution.

Impact:

1. **Reduced computer size:** The microprocessor enabled the development of computers that could fit on a desk rather than filling entire rooms.
2. **Increased processing speed:** Continued improvements in microprocessor design led to exponential increases in computational power.
3. **Enabled personal computers:** The affordability and compact size of microprocessor-based systems made individual computer ownership possible for the first time.

### 2.5 Personal Computers (PC)

Personal computers became popular in the 1980s, democratizing access to computing power and transforming society. For the first time, individuals could own powerful computing devices for personal and professional use, leading to revolutionary changes in how people work, learn, and communicate.

Examples:

- **IBM PC:** Released in 1981, this machine established the standard for personal computing and spawned an entire ecosystem of compatible computers.
- **Apple Macintosh:** Introduced in 1984, the Macintosh popularized the graphical user interface and made computing more accessible to non-technical users.

Advantages:

1. **Affordable for individuals:** Competition and technological advances drove down prices, making computers accessible to a broad consumer market.
2. **Easy to use:** Improvements in user interfaces and software made computers approachable for people without specialized training.
3. **Widely used in education and business:** Personal computers became essential tools in schools, offices, and homes around the world.



### 3.Importance of Computing in Cybersecurity

Computing plays a crucial role in cybersecurity. As our reliance on digital systems has grown, so too has the importance of protecting these systems from threats. The same computing technologies that enable modern business and communication also provide the tools necessary to secure them.

#### Applications include:

1. Data protection: Computing systems implement encryption, access controls, and backup mechanisms to safeguard sensitive information from unauthorized access or loss.
2. Network monitoring: Automated systems continuously monitor network traffic for suspicious activity, enabling rapid detection and response to potential threats.
3. Security analysis: Advanced computing capabilities enable security professionals to analyze threats, identify vulnerabilities, and develop effective countermeasures.
4. Encryption systems: Mathematical algorithms implemented in computing systems protect data confidentiality and integrity during transmission and storage.

#### Examples of cybersecurity tools:

1. Firewalls: Hardware or software systems that monitor and filter network traffic based on security rules, creating a barrier between trusted and untrusted networks.
2. Intrusion Detection Systems (IDS): Software that monitors network or system activities for malicious activities or policy violations and generates alerts when detected.
3. Encryption technologies: Tools and protocols that transform data into unreadable formats, protecting information from unauthorized access even if intercepted.

### Classroom Activity 1

*Divide students into small groups (3–4 students).*

Ask them to arrange the following developments in chronological order:

1. Personal Computers
2. Mechanical Calculators
3. Microprocessors
4. Punched Cards

#### Then discuss:

*Which development had the greatest impact on modern technology? Consider factors such as accessibility, computational power, and societal transformation when forming your arguments.*



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## Classroom Activity 2

Discussion Question:

How did the development of computers contribute to the emergence of:

1. The Internet: Consider how advances in networking, computing power, and software enabled the creation of global communication networks.
2. Social media: Explore how personal computers, smartphones, and web technologies created platforms for global social interaction.
3. Cybercrime: Analyze how the same technologies that enable legitimate online activities also create opportunities for criminal behavior.

*Students discuss their ideas in groups, drawing connections between technological capabilities and social outcomes.*

## Homework (Lecture 1)

Write a short report (1 page) on the following topic:

***"The Role of Computer Development in the Emergence of Cybersecurity."***

**The report should include:**

1. At least three stages of computer evolution, explaining how each contributed to the development of cybersecurity practices and technologies.
2. Their impact on information security, discussing how technological advances created both new security challenges and new protective capabilities.