The Digital Age

Overview of the Revolution in Computers & Communications

- Analog vs. digital
- Technological convergence
- Major elements of a computer-and-communications system
- Information technology professional and end-user
- Data and information
- The five operations of a computer-and-communications system
- The difference between applications software and systems software
- The five major categories of computers
- Information Superhighway
Analog vs. digital

Digital data: data in discrete, discontinuous form
---- usually 0s & 1s

Analog data: data in a continuous form

Computer + Communication

Technological Convergence
Fusion of computer & communication technology

Computer Technology

3000 BC
- Chinese armor, used for warfare
- Calculus developed in Oxford

200 BC
- Chinese armor, developed in engineering
- Mechanical technology

Communications Technology

35,000 BC
- Language probably existed

3000 BC
- Semitonic writing on clay tablets

3000 AC
- Early Egyptian hieroglyphics

600 AC
- Mechanical alphabet

1453 AD
- Book printing in Europe

First mechanical printing machine (Donato Rosseli)
First printing press in North America
Photographs on metal plates
Morse’s telegraph (first long-distance digital communication system)
Trans-Atlantic telephone cable laid

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The crank-driven difference engine, built by Charles Babbage in England in the 1830s.

ENIAC ("Electronic Numerical Integrator and Computer") , 1946.

- FIRST working electronic digital computer!!
- Developed by Mauchly & Eckert in 1943 at the University of Pennsylvania.
- Used to solve ballistic problems
- 1000 x faster than Mark I
- Weighed 30 tons, 2 stories high, occupied a room thirty by fifty feet, used 200,000 Watts of power!
Replacing a bad tube meant checking among ENIAC's 19,000 possibilities.

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Two women wiring the right side of the ENIAC with a new program.

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The Electronic Discreet Variable Computer (EDVAC)

- Developed by John von Neumann.
- Used 1/10th the equipment required by ENIAC.
- EDVAC used stored program in memory and used magnetic disks.

UNIVAC I, circa 1951, was the first computer to be mass produced for general use.
**Punched card:** most computers of the first and second generations replied heavily on punched-card input.
IBM present and founder in the 1930s, *Thomas J. Watson Sr.*, is shown here greeting some of his sales force. Watson pioneered the marketing of computer systems—selling business solutions rather than just electronic boxes.
Typical UNIVAC® 1108 Prices: 1968

The following are representative prices for UNIVAC 1108 components as of 1968 (in 1968 dollars). These are "Basic" prices, quoted to customers who perform all their own maintenance and support. These are regular commercial prices; educational institutions typically received a 25% discount on purchase price.

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Purchase Price</th>
<th>Installation Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>3011-95</td>
<td>1108 CPU</td>
<td>$566,460</td>
<td>$2,200</td>
</tr>
<tr>
<td>7005-72</td>
<td>131 K word Core Memory</td>
<td>$823,500</td>
<td>$2,250</td>
</tr>
<tr>
<td>5009-00</td>
<td>FASTRAND™ Controller</td>
<td>$134,400</td>
<td>$1,080</td>
</tr>
<tr>
<td>6010-00</td>
<td>FASTRAND II Storage Unit</td>
<td>$67,360</td>
<td>$600</td>
</tr>
<tr>
<td>5012-00</td>
<td>FH-432/FH-1782 Drum Controller</td>
<td>$95,680</td>
<td>$540</td>
</tr>
<tr>
<td>6016-00</td>
<td>FH-432 Drum (capacity 262,144 words)</td>
<td>$34,640</td>
<td>$480</td>
</tr>
<tr>
<td>6015-00</td>
<td>FH-1782 Drum (capacity 2,097,152 words)</td>
<td>$95,680</td>
<td>$540</td>
</tr>
<tr>
<td>4009-99</td>
<td>Console (TTY-35)</td>
<td>$29,365</td>
<td>$200</td>
</tr>
</tbody>
</table>

Notes

The depreciation of the U.S. dollar since 1968 makes a benchmark of the value of the dollar in those days useful. In 1968, a sporty domestic automobile, the Chevrolet Malibu Sport Coupe with a 307-cid V-8 engine cost US$2663, 696 times less than a megabyte of UNIVAC core memory.
**Apple I, 1976, $666.66**
Processor: MOS6502, 1MHz,  
Memory: 8K RAM, 256B ROM  
OS: BASIC  
Storage: cassette

Apple I built by Steve Wozniak and Steve Jobs of the Apple's founders.

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**Apple II, 1977, $999**
Processor: MOS6502, 1MHz,  
Memory: 4K RAM, ROM??  
OS: BASIC  
Storage: 5.25" 140K FD's or cassette

**Apple II+, 1977, $???**
Processor: MOS6502, 1MHz,  
Memory: 48K RAM, 16K ROM  
OS: BASIC, DOS  
Storage: 5.25" 140K FD's or cassette

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Cray supercomputer series

Cray-1, 1976, 136Mflops

Cray-2, 1985, 1.9Gflops

Cray T90 series, 60Gflops

Cray C90, 1991, 16Gflops

Major elements of a computer-and-communications system

- people
- procedures
- data/information
- hardware
- software

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People

- **Professionals**: a person who has had formal education in the technical aspects of using a computer-and-communications system.
- **End-users**: or simply a user, is someone without much technical knowledge of information technology who uses computers for entertainment, education, or work-related tasks.

Procedures

- Procedures are steps for accomplishing a result.
- Some procedures may be expressed in manuals or documentation. Documentation is also available online.
Data and information

- **Data** (or **Raw data**) consists of the raw facts and figures that are processed into information.
- **Information** is summarized data or otherwise manipulated data that is useful for decision making.

Units of Measurement for Capacity:
- **bit**
- **Byte** (= 8 bits)
- **Kilobyte, KB** (= $2^{10}$ bytes)
- **Megabyte, MB** (= $2^{20}$ bytes)
- **Gigabyte, GB** (= $2^{30}$ bytes)
- **Terabyte, TB** (= $2^{40}$ bytes)

Hardware

- Input
  - keyboard
  - mouse
  - scanner
  - and......

- Processing
  - CPU
  - main memory
  - and......

- Output
  - screen
  - printer
  - sound devices
  - and......

- Storage
  - diskette
  - hard disk
  - magnetic tape
  - and......

- Communication
  - modems
  - and......
**Input Hardware**

- Keyboard
- Mouse
- Scanners

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**The basic operations of computing**

1. **Input Phase**
   - Keyboard
   - Mouse

2. **Processing Phase**
   - Central processing unit (CPU)
   - Data memory

3. **Output Phase**
   - Monitor

4. **Storage Phase**
   - Diskette
   - Handheld
   - Magnetic tape
   - Optical storage

5. **Communication Phase**
The system unit (motherboard)

RAM (main memory) chips mounted on modules (cards)

Microprocessor chip (with CPU)

System Cabinet

Power connector
Hard disk unit
Data transfer cable ribbon
Speaker
Power supply
3 1/2-inch diskette drive
5 1/4-inch diskette drive
On/Off switch
CD-ROM optical-disk drive
Output Hardware

- Screen
- Printer
- Sound
Software

Software comprises the step-by-step instructions that tell the computer what to do. There are two categories:

- **Applications software**: software that people use to perform a general-purpose task, such as word processing software used to prepare the text for a document, e.g., office97, database.

- **System software**: software used to manage its own internal activities and run applications software, e.g., MS-DOS, Windows 98, Unix
Most data we communicate are analog data but variety of suppliers providing data in digital form. The kind of data being communicated is rapidly changing from analog to digital.

Development in Computer Technology

- smaller size
- more power
- less expense
The five major categories of computers

- Supercomputers
- Mainframe computers
- Minicomputers
- Microcomputers
- Microcontrollers

Development in Communication Technology

- Better Communications Channels
- Better Networks
- Better Sending & Receiving Devices

Cellular phones
Fax machines
Connectivity

- Voice mail and e-mail
- Telecommuting
- Teleshopping (e-commerce)
- Databases
- Computer online services and networks and the Internet
- Electronics bulletin board system
Interactivity

- Multimedia computers
- Personal digital assistants (PDAs)
- Up-and-coming “smart boxes” and “Internet appliances”.

Information Superhighway

A vision or a metaphor for a fusion of the two-way wired and wireless capabilities of telephones and networked computers with cable-TV’s capacity to transmit hundreds of programs. The resulting interactive digitized traffic would include movies, TV shows, phone calls, databases, shopping services, and online services.
The Ethics of Information Technology

- Speed and scale
- Unpredictability
- Complexity

The “All-Purpose” Machine

In the future, we may have an “information appliance” a device that combines telephone, television, VCR, and personal computer. This device will deliver digitized entertainment, communications, and information.

The basis of the information appliance may be the personal computer although it may come in various sizes, shapes, degrees of portability. The device will properly become increasingly “user-friendly” and will have multimedia capability.