Technology Briefing

Information Systems Hardware

*Information Systems Today: Managing in the Digital World*
Learning Objectives

1. Describe key elements of information systems hardware.
2. List and describe the types of computers that are being used in organizations today.
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Key Elements of Information Systems Hardware

- **Input Devices**
  - Used to enter information into a computer

- **Processing Devices**
  - Transform inputs into outputs.

- **Output Devices**
  - Deliver information to users in a usable format

Input: Mouse and Keyboard

Output: Monitor

Processing: CPU

*Information Systems Today: Managing in the Digital World*
Input Devices

- Entering Text and Numbers
  - Keyboard
    - Traditional
    - Ergonomic
    - Virtual

Virtual Laser Keyboard
Pointing and Selecting Devices

- E.g., mouse, light pen, touch pad, touch screen, joystick, and eye-tracking device
Entering Batch Data

- Used for repetitive information
  - Scanners
    - (a) Handheld scanner
    - (b) Flatbed scanner
Other Scanning Technologies

- Text recognition software
- Optical character recognition (OCR)
- Optical mark recognition (OMR)
- Magnetic ink character recognition (MICR)
- Barcode readers
Other Scanning Technologies (II)

• Smart Cards
  o Contain:
    • microprocessor chip
    • memory circuits
    • magnetic stripe
  o Uses:
    • Photo-identification cards
    • Contactless transmission using RFID technology

• Biometric devices
  o Read:
    • Iris
    • Fingerprints
    • Face geometry
Audio Input

• Audio - sound that has been digitized

• Voice Input
  o Microphone
  o Speech recognition
  o Voice-to-text software

• Other Forms of Audio Input
  o Electronic keyboards
  o Transfer from another device
Video Input

• Digital camera

• Streaming video
  o Compressed form of video that can be sent over the Internet

• Streaming media
  o Streaming video with sound
Processing: Transforming Inputs into Outputs

• Binary Code
  o Binary or base-2 math (2, 4, 8, 16, 32, etc.)
    • Bits
    • Bytes
  o Machine Language – the language computers understand
  o ASCII (American Standard Code for Information Interchange)
Translation Into Binary Code

What you see on the screen: "HELLO"

8-bit ASCII binary code:
- H: 01001000
- E: 01000101
- L: 01001100
- L: 01001100
- O: 01001111

What is stored and manipulated inside the computer:
- 01001000
- 01000101
- 01001100
- 01001100
- 01001111
System Unit

• Motherboard, power supply, and fan
• Central processing unit (CPU)
• RAM and ROM memory

• Hard drive, CD-ROM or DVD-ROM drive
• Ports for plugging in peripherals
Motherboard

• Contains all components that do the actual processing work of the computer
• Other components are connected to it
Central Processing Unit (CPU)

- Microprocessor, processor, chip
- Responsible for performing all of the operations of the computer
  - Arithmetic logic unit (ALU):
    - Perform math and logical operations
  - Control unit:
    - Fetch program instructions
    - Decode instructions
    - Retrieve data
    - Store results
Moore’s Law

• In the 1970s Dr. Gordon Moore from Intel hypothesized that processing performance would double every 18 months

• Reduction of feature size
Clock Speed

• Pulses setting the pace for processing events
  ○ Clock tick: single pulse
  ○ Clock speed is measured in hertz (Hz)

• Personal computer clock speeds:
  ○ First IBM PC was 4.77 MHz
  ○ Today, 3-4 GHz
Registers and Cache Memory

• Registers
  o Part of the CPU
  o Temporary storage for data processed or manipulated by CPU

• Cache memory
  o Storage for most recently or most frequently used data
    • Internal cache – incorporated into the CPU (L1)
    • External (or secondary) cache – located close to the CPU (L2)
Primary Storage

• For temporary storage to support computer processing
• Random-access memory (RAM) and read-only memory (ROM)
Random-Access Memory (RAM)

- Computer’s main or primary memory
- Stores the programs and data currently in use
- Volatile: memory is lost when the computer is turned off
- Memory wall
Read-Only Memory (ROM)

- Can be read but cannot be written to
- Nonvolatile
- BIOS

- Erasable ROM (EEPROM):
  - Flash memory
  - Can be written to and erased
  - Secondary storage / Removable
Secondary Storage

- Nonvolatile storage for permanently storing data
  - E.g., Hard disk, CD-ROM disk

<table>
<thead>
<tr>
<th>Type</th>
<th>Speed</th>
<th>Method of Data Access</th>
<th>Relative Cost / MB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnetic tape</td>
<td>Slow</td>
<td>Sequential</td>
<td>Low</td>
</tr>
<tr>
<td>Floppy disk</td>
<td>Slow</td>
<td>Direct</td>
<td>Low</td>
</tr>
<tr>
<td>Fixed disk</td>
<td>Fast</td>
<td>Direct</td>
<td>High</td>
</tr>
<tr>
<td>Compact discs</td>
<td>Medium</td>
<td>Direct</td>
<td>Low</td>
</tr>
<tr>
<td>Optical disks</td>
<td>Fast</td>
<td>Direct</td>
<td>Medium</td>
</tr>
<tr>
<td>Flash drive</td>
<td>Fast</td>
<td>Direct</td>
<td>High</td>
</tr>
</tbody>
</table>
Hard Drives and Diskettes

- **Hard Drives**
  - Several magnetic disks
  - Read/write heads
  - High storage capacity
  - RAID

- **Diskettes**
  - Portable magnetic media
Optical Disk Storage

• Uses laser beam technology to read and write
  o CD-ROMs (compact disc-read-only memory)
    • CD-R
    • CD-RW
  o DVD-ROM (digital versatile disk-read-only memory)
    • Shorter-wavelength laser beam
    • Digital Video Disks
    • HD-DVD vs. Blu-Ray
Magnetic Tapes

• Used for large-capacity storage
• Reels or cassettes
• Density:
  o Characters per inch
  o Bytes per inch
Ports

- Hardware interfaces – plugs and sockets

<table>
<thead>
<tr>
<th>Port Name</th>
<th>Used to Connect</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial</td>
<td>Modem, mice, keyboard, terminal display, MIDI</td>
<td>• Used to transfer one bit at a time</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Slowest data transfer rates</td>
</tr>
<tr>
<td>Parallel</td>
<td>Printer</td>
<td>• Used to transfer several bits concurrently</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Many times faster than serial</td>
</tr>
<tr>
<td>USB (Universal Serial Bus)</td>
<td>Printer, scanner, mice, keyboard, digital camera and</td>
<td>• A very high speed data transfer method</td>
</tr>
<tr>
<td></td>
<td>camcorders, external disk drives</td>
<td>• Up to 480 million bytes per second</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Up to 127 devices simultaneously connected</td>
</tr>
<tr>
<td>IEEE 1394 (&quot;Fire Wire&quot;)</td>
<td>Digital camera and camcorders, external disk drives</td>
<td>• Extremely high speed data transfer method</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Up to 800 million bytes per second</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Up to 63 devices simultaneously connected</td>
</tr>
</tbody>
</table>
Output Devices: Video Output

• Used to display information from a computer
  o Cathode Ray Tube (CRT)
  o Liquid Crystal Display (LCD)
  o Organic light-emitting diodes (OLED)
  o Projectors
Printers and Plotters

- Plotter
- Dot Matrix
- Ink-jet
- Laser
Audio Output

- Sound card and speakers
  - Sound card translates digits into sound
  - Also used to capture sound
- Other audio output
  - E.g., USB headphones
Learning Objectives

1. Describe key elements of information systems hardware.
2. List and describe the types of computers that are being used in organizations today.
Supercomputers

- Users: 1-to-many
- Size: Automobile – multiple rooms
- Typical use: Scientific research
- Memory: 500+ GB
- Cost: $1-20 million
Mainframes

- Users: 1000+
- Size: Refrigerator
- Typical use: Large general purpose business & gov’t
- Memory: <100+ GB
- Cost: $1-10 million
Midrange Computers

- Users: 5-500
- Size: File cabinet
- Typical use: Midsize general purpose business
- Memory: <20 GB
- Cost: $10,000-100,000
Microcomputers or PCs

- Users: 1
- Size: handheld – fitting on desktop
- Typical use: personal productivity
- Memory: 512MB - 2GB
- Cost: $200-5,000
Network Computers

• AKA thin clients
• Minimal memory and storage
• Servers do the processing
• Reduce obsolescence & maintenance
Portable Computers

• Notebook computers
  • Light weight
  • Battery powered
  • Limited expandability
  • Docking stations
Tablet PCs

- Type of notebook that accepts input from an electronic pen
  - Slate model
  - Convertible model
Handheld Computers

- Small computers that can be carried in a pocket
- Niche in the portable computers market
  - Personal digital assistants (PDAs)
  - Cell phones
- Most popular manufacturers
  - RIM – Blackberry
  - Palm – Treo