What is Output?

- Data that has been processed into a useful form, called information.

What Are Output Devices?

What is an output device?

- Any hardware component that can convey information to a user.

Display Devices

What is a display device?

- Television-like
- Information on a display device sometimes is called soft copy.

Display Devices

What is a CRT monitor?

- Large sealed, glass screen
- Screen coated with tiny dots of phosphor material
- Pixel, or picture element, is single point in electronic image
- Three dots (red, blue, and green) combine to make up each pixel.
Display Devices

What are typical sizes for CRT monitors?
- 15, 17, 19, 21, and 22 inch screen size
- Viewable size is diagonal measurement of actual viewing area provided by the monitor

Display Devices

What is a liquid crystal display (LCD) monitor?
- Type of flat-panel display
- Uses liquid crystals between two sheets of material to present information on screen
- Electric current passes through crystals, which creates images on the screen

Display Devices

Where are some features of LCD screens?
- Lightweight and compact
- Consumes less than one-third of the power than does a CRT monitor
- Ideal for notebook and handheld computers

Display Devices

What is a Web-enabled device?
- Allows access to the Web or e-mail
  - Cellular telephones
  - Pagers
- Many use monochrome LCD displays to save battery power

Display Devices

What is an electronic book (e-book) ?
- Small, book-sized computer that uses an LCD screen
- Allows users to read, save, highlight, bookmark, and add notes to online text
- Download new book content from Web

Display Devices

What are the two technologies used for LCD monitors?
- Active-matrix display
  - Can display high-quality color viewable from all angles
- Passive-matrix display
  - Color often not as bright
  - Images best viewed when working directly in front of display
Display Devices

What is a gas plasma monitor?
- Flat-panel display uses layer of gas plasma between two sheets of material
  - Larger screen sizes and higher display quality than LCD, but much more expensive

What is dot pitch?
- Measure of the distance between pixels
- Sometimes called pixel pitch
- Smaller the distance between the pixels, the sharper the image

What is refresh rate?
- Speed at which monitor redraws images on the screen
  - Should be fast enough to maintain a constant, flicker-free image
  - High-quality monitor will provide refresh rate of at least 75 hertz
  - Image on the screen redraws itself 75 times per second

What is display resolution?
- Describes the sharpness and clarity of image
  - The higher the resolution, the sharper the image and the more that can display on the monitor

What is a video card?
- Converts digital output from computer into analog video signal
- Controls how display device produces picture
- Also called graphics card or video adapter

How does video travel from the processor to a CRT monitor?
1: Processor sends digital data to video card
2: Video card converts digital data to analog signal
3: Analog signal sent via cable to CRT monitor
4: CRT separates signal into red, green, and blue signals
5: Electron guns fire color signals to front of CRT
6: Image displays
What is bit depth?
- Number of bits a video card uses to store information about each pixel
- Also called color depth
- Determines number of colors a video card can display
- Greater the number of bits, better the resulting image

5-bit video card
- Uses 5 bits to store information about each pixel
- Can display 2^5 = 32 different colors

24-bit video card
- Uses 24 bits to store information about each pixel
- Can display 2^24 = 16.7 million colors

What are video standards?
- Video Electronics Standards Association (VESA) develops video standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Suggested Resolution</th>
<th>Preferred Simultaneous Colors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adobe Macromedia Display Adapter (AMDA)</td>
<td>720 x 350</td>
<td>1 for text</td>
</tr>
<tr>
<td>Video Graphics Array (VGA)</td>
<td>640 x 480</td>
<td>16</td>
</tr>
<tr>
<td>Extended Graphics Array (EGA)</td>
<td>320 x 200</td>
<td>256</td>
</tr>
<tr>
<td>Super Video Graphics Array (SVGA)</td>
<td>1024 x 768</td>
<td>256</td>
</tr>
<tr>
<td>Beyond SVGA</td>
<td>1280 x 1024</td>
<td>65,536</td>
</tr>
</tbody>
</table>

What are various video card configurations?

<table>
<thead>
<tr>
<th>Video Memory</th>
<th>Color Depth</th>
<th>Number of Colors</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 MB</td>
<td>8-bit</td>
<td>256</td>
<td>1024 x 768</td>
</tr>
<tr>
<td></td>
<td>16-bit</td>
<td>65,536</td>
<td>1024 x 768</td>
</tr>
<tr>
<td>2 MB</td>
<td>8-bit</td>
<td>256</td>
<td>1024 x 768</td>
</tr>
<tr>
<td></td>
<td>16-bit</td>
<td>65,536</td>
<td>1280 x 1024</td>
</tr>
<tr>
<td>4 MB</td>
<td>24-bit</td>
<td>16.7 million</td>
<td>1024 x 768</td>
</tr>
<tr>
<td>8 MB</td>
<td>24-bit</td>
<td>16.7 million</td>
<td>1280 x 1024</td>
</tr>
<tr>
<td>16 MB</td>
<td>32-bit</td>
<td>16.7 million</td>
<td>1600 x 1200</td>
</tr>
<tr>
<td>32 MB</td>
<td>32-bit</td>
<td>16.7 million</td>
<td>2048 x 1536</td>
</tr>
</tbody>
</table>

What is electromagnetic radiation (EMR)?
- Magnetic field that travels at speed of light
- Small amount produced by all CRT monitors

EMR is greatest on sides and back of CRT monitor. LCD monitors do not pose this risk.

What is the ENERGY STAR® program?
- Program to encourage manufacturers to create energy-efficient devices that require little power when not in use
- Monitors and devices meeting guidelines display ENERGY STAR® label

Interactive TV
- Two-way communications technology in which users interact with television programming
- HDTV works directly with interactive TV
What is a printer?
- Output device that produces text and graphics on paper
- Result is hard copy, or printout
- Two orientations: portrait orientation and landscape orientation

What is an impact printer?
- Forms characters by striking a mechanism against ink ribbon that physically contacts paper
- Ideal for printing multipart forms
- Can withstand dusty environments, vibrations, and extreme temperatures

What is a dot-matrix printer?
- Impact printer that produces printed images when tiny wire pins on print head mechanism strike inked ribbon
- Most use continuous-form paper
- When ribbon presses against paper, it creates dots that form characters and graphics
- A higher number of pins (9 to 24) means printer prints more dots per character, which results in higher print quality

What is a line printer?
- High-speed impact printer that prints entire line at a time
- Speed measured by number of lines per minute (lpm) it can print
- Band printer prints fully-formed characters using a hammer mechanism
- Shuttle-matrix printer is high-speed printer that works more like a dot-matrix printer

What is a non-impact printer?
- Forms characters and graphics on piece of paper without actually striking paper
- Ink-jet printer
- Thermal printer
- Laser printer
Printers

What is an ink-jet printer?
- Nonimpact printer forms characters and graphics by spraying tiny drops of liquid ink onto piece of paper
- Most popular type of color printer for home use

What is the resolution of a printer?
- Sharpness and clarity of characters
- Measured by number of dots per inch (dpi)
- Printer can output 300 dpi, 600 dpi, 1,200 dpi

How does an ink-jet printer work?
1: Small resistor heats ink, causing ink to boil and form vapor bubble
2: Vapor bubble forces ink through nozzle
3: Ink drops onto paper
4: As vapor bubble collapses, fresh ink is drawn into firing chamber

How does a laser printer work?
1: Drum rotates as paper is fed through
2: Mirror deflects laser beam across surface of drum
3: Laser beam creates charge that causes toner to stick to drum
4: As drum rotates, toner transfers from drum to paper
5: Rollers use heat and pressure to fuse toner to paper

What is a thermal printer?
- Generates images by pushing electrically heated pins against heat-sensitive paper
- Ideal for small devices, such as adding machines
Printers

What is a photo printer?
• Color printer that produces photo lab quality pictures and prints everyday documents

What is a label printer?
• Small printer that prints on adhesive type material that can be placed on a variety of items
• Most also print bar codes and e-stamps

What is a portable printer?
• Small, lightweight ink-jet or thermal printer that allows mobile user to print from notebook or handheld computer while traveling

What is a plotter?
• Sophisticated printer used to produce high-quality drawings
• Large-format printer similar to plotter and is used to print quality color prints

Speakers and Headsets

What is an audio output device?
• Computer component that produces music, speech, and other sounds
• Speakers and headsets are common devices

What is voice output?
• Computer talks to you through speakers on computer
**Speakers and Headsets**

What is Internet telephony?

- Allows you to have a conversation over the Web, just as if you were talking on the telephone.

**Other Output Devices**

What is a data projector?

- Device that takes an image from a computer screen and projects it onto a larger screen.

What is a facsimile (fax) machine?

- Device that transmits and receives documents over telephone lines.

What is a fax modem?

- Modem that allows you to send and receive electronic documents as faxes.

What is a multifunction device (MFD)?

- Provides the functionality of a printer, scanner, copy machine, and fax machine.

**Terminals**

What is a terminal?

- Device that performs both input and output.
Terminals

What is a **dumb terminal**?
- Has a keyboard and monitor, but no processor or memory
- Connects to host computer that performs processing and then sends output back

What is an **intelligent terminal**?
- Has monitor, keyboard, memory, and processor
- Similar to a PC in that it can perform tasks independent of host computer
- Programmable

What is a **point-of-sale (POS) terminal**?
- Records purchases at point where purchase is made
- Output from POS terminals serves as input to host computer

What is an **automated teller machine (ATM)**?
- Self-service banking machine that connects to host computer through telephone network

Output Devices for Physically Challenged Users

What is the **Magnifier command**?
- Windows Magnifier command enlarges text and other items in window on screen

What other output options are available for visually impaired users?
- Change Window’s settings such as increasing size or changing color of text to make words easier to read
- Blind users can work with voice output
- Braille printer outputs information in Braille onto paper
Summary
What are suggested output devices for the Home user?
- 17- or 19-inch color CRT monitor
- High-definition television
- Ink-jet color printer; or photo printer; or label printer
- Speakers and headset

Putting It All Together
What are suggested output devices for the SOHO user?
- 19- or 21-inch color CRT monitor
- Color LCD display for handheld computer
- Multifunction device; or ink-jet color printer; or laser printer, black and white
- Label printer
- Fax machine
- Speakers and headset

Putting It All Together
What are suggested output devices for the Mobile user?
- 15.4-inch color LCD display with notebook computer
- 19-inch color CRT monitor for notebook computer docking station
- Color LCD display for handheld computer
- Portable printer
- Ink-jet color printer; or laser printer, black and white, for in-office use; or photo printer
- Fax modem
- Headset
- DLP data projector

Putting It All Together
What are suggested output devices for the Large Business user?
- 19- or 21-inch color CRT or LCD monitor
- 15.4-inch color LCD display for notebook computer
- Color LCD display for handheld computer
- Laser printer, black and white
- Line printer (for large reports from mainframe)
- Label printer
- Fax machine or fax modem
- Speakers and headset
- DLP data projector
- Dumb terminal

Putting It All Together
What are suggested output devices for the Power user?
- 21-inch color LCD monitor
- Laser printer
- Plotter
- Photo printer; or dye sublimation printer
- Fax machine or fax modem
- Speakers and headset

Summary of Output
- What is output?
- What are output devices?
- Display devices
- Printers
- Speakers and headsets
- Other output devices
- Terminals
- Output devices for physically challenged users

Chapter 6 Complete