Printers

Overview

• In this part, you will learn to
  – Describe current printer technologies
  – Explain the laser printing process
  – Install a printer on a Windows PC
  – Troubleshoot basic printer problems

Printer Technologies

Impact Printers

• Impact printers leave an image on the paper by physically striking an inked ribbon against the surface of the paper
  – Used for multipart forms
  – Relatively slow and noisy
• Daisy-wheel and dot-matrix are two prominent types of impact printers

Daisy-Wheel Printers

• Daisy-wheel printers
  – Print data in a single font and only in one size
  – Lack flexibility

Dot-Matrix Printers

• Dot-matrix printers
  – More flexibility than daisy-wheel printers
  – Use an array of pins known as printwires to strike an inked printer ribbon and produce images on paper.
  – The case that holds the print wires is called the printhead
  – Use either 9-pin (draft quality) or 24-pin (letter or near-letter quality)
Inkjet Printers

- **Inkjet printers** are simple devices that consist of the printhead mechanism, support electronics, a transfer mechanism, and a paper feed component.
  - Work by ejecting ink through tiny tubes
  - Ink is heated by tiny resistors or electroconductive plates at the end of each tube
  - The resistors or plates boil the ink which creates a tiny air bubble that ejects a droplet of ink on the paper
  - Ink inside the jets tend to dry out when not used
- Most color printers are ink-jet and produce a high-quality image

Inside an Inkjet Printer

**Inkjet Printhead**

**Two Key Features**

- dpi
- ppm

Dye-Sublimation Printers

- **Dye-sublimation** printers (or thermal dye transfer printers) use sublimation
  - Sublimation causes something to change from a solid form into a vapor and then back into a solid
  - Used for fine detail and rich color over cost and speed
  - Snapshot printers are smaller versions for printing photos
  - Used for medical and scientific imaging

Dye-Sublimation Process

- Uses rolls of heat-sensitive plastic film
- Print head with thousands of heating elements moves across the page to vaporize the dyes so they’ll soak into the specialized paper
- Requires one pass per page for each color
  - Cyan, Magenta, Yellow, Black (CMYB)
Thermal Printers

- **Thermal printers**
  - Two types: Direct thermal and Thermal wax
  - Use a heated print head to burn dots into the surface of special heat-sensitive paper
  - Still used for receipts at some businesses

Laser Printers

- **Laser printers** use a mechanism called electro-photographic imaging, to produce a high quality and high-speed output of both text and graphics
  - More expensive than ink-jet or impact printers
  - Use lasers as a light source
  - The toner cartridge contains the parts that suffer the most wear and tear

Laser Printer Parts

- **Photosensitive drum**
  - Aluminum cylinder coated with particles of photosensitive compounds
- **Erase lamp**
  - Exposes the entire surface of the photosensitive drum to light
- **Primary corona**
  - Enables voltage to pass to the drum and charge the photosensitive particles on its surface
- **Laser**
  - Acts as the writing mechanism of the printer

Laser Printer Parts

- **Toner**
  - Fine powder made up of plastic particles bonded to iron particles
- **Transfer corona**
  - Applies a positive charge to the paper
- **Fuser**
  - Attaches the toner permanently to the paper using the pressure roller and heated roller
- **Fuser assembly**
  - Fuses the toner to the paper

Laser Printer Parts

- **Power supply**
  - Primary power supply provides power to the motors that move the paper, system electronics, and transfer corona
  - High-voltage power supply provides power to the primary corona
  - When inserting a new toner cartridge, always turn the laser printer off before opening it
- **Turning gears**
  - Discrete units called gear packs or gearboxes
- **Transfer corona**
  - Thin wire that applies a positive charge to the paper, drawing the negatively charged toner particles to the paper

Laser Printer Parts

- **System board**
  - Contains the main processor, ROM, and RAM
  - If you don’t have enough RAM you’ll get a memory overflow error
  - Most printers may use generic DRAM like the kind you use for your PC
- **Ozone filter**
  - Even tiny concentrations of ozone (O3) will damage printer components
  - Filter needs to be replaced periodically
- **Sensors and Switches**
  - To alert paper jams, empty paper trays, low toner levels
Laser Printer Components

Printer Languages

- **American Standard Code for Information Interchange (ASCII)**
  - Basic alphanumeric characters and a variety of control codes for transferring data and to control printers
  - Limited in its capability

- **Hewlett Packard developed the Printer Control Language (PCL)**
  - Expanded set of printer commands
  - Dependent on the printer hardware
  - Does not support advanced graphical functions
  - Does not define the page as a single raster image

Printer Languages

- **The PostScript Page Description Language (PDL) developed by Adobe**
  - Device independent printer language capable of high-resolutions and scalable fonts
  - Printers print faster because most of the image processing is done by the printer and not the PC
  - Postscript files are very portable

- **The Windows Graphical Device Interface (GDI) component of the operating system handles print functions**
  - If the printer has a capable RIP and enough RAM, you don't need to worry about the printer language

Printer Connectivity

- **Most printers connect to one of two ports on the PC**
  - DB25 parallel port
  - USB port

Parallel Communication

- **The parallel port was a lot faster than the existing serial ports at the time**
  - Slow by today's standards with a maximum data transfer rate of 150 KBps
  - IEEE (Institute of Electrical and Electronics Engineers) 1284 Standard addressed standardizing parallel ports
    - See [www.ieee.org](http://www.ieee.org) to learn more about the organization

IEEE 1284 Standard

- **The IEEE 1284 standard requires**
  - Support for all five modes of operation
    - Compatibility or centronics mode
    - Nibble mode
    - Byte mode
    - Enhanced parallel port
    - Extended capability port
  - Standard methods of negotiation for determining which modes are supported by the host PC and by peripheral devices
  - A standard physical interface
  - A standard electrical interface
Connections, Cabling, and Electricity

- A ‘standard printer cable’ refers to a printer cable with a male DB25 connector on one end and a 36-pin Centronics connector on the other.
- These cables are acceptable for transferring data at 10 KBps and distance less than six feet.

USB Printers

- Most new printers now use USB connections
  - And they come with the cable!

The Laser Printing Process

1. Before each new page the photosensitive drum is cleaned:
   - Physically by scraping the surface of the drum with a rubber cleaning blade
   - Electrically with an erase lamp to completely discharge any particles
2. Next the drum is charged by applying a negative charge to the entire surface.

The Physical Printing Process

3. A laser is used to write and develop a positive image on the surface of the drum
   - Every particle hit by the laser will release most of its negative charge into the drum
4. Using the transfer corona, the paper is charged positively. The negatively charged toner particles leap from the drum to the paper
5. The heat roller made of a non-stick material and the pressure roller are used to fuse the image on the paper
• **Raster image**
  - Laser printers generate a raster image of the page
  - A raster image is a pattern of dots
  - Laser printers use a chip called the Raster Image Processor (RIP) to translate the raster image sent to the printer into commands to the laser
  - The RIP needs memory (RAM) in order to store this data
    - If there is insufficient memory you’ll get a Mem Overflow error – add more memory, reduce the resolution, print smaller graphics, or turn off RET
    - The HP LaserJet 21 error message means the data is too complex for the RIP – reduce the complexity by using fewer fonts, less formatting, reducing graphics resolution, etc.

• **Resolution**
  - A laser printer can print at different resolutions based on its physical characteristics
  - Resolution is expressed in dots per inch (dpi) such as 600x600 or 1200x1200 dpi
    - The first number is the horizontal resolution – how fine a focus can be achieved by the laser
    - The second number is the vertical resolution – the smallest increment by which the drum can be turned
  - Resolution Enhancement Technology (RET) enables the printer to insert smaller dots among the characters to smooth out jagged curves

---

**Installing a Printer in Windows**

**Printing in Windows 9x/Me**

- **Windows 9x**
  - The application sends the print job to the print spooler
  - The print spooler works with the print driver to format the print job in a language the printer understands and then “spools” or stores it on the hard drive
  - The print job is then sent to the printer

**Printing in Windows NT/200/XP**

- **Windows 2000**
  - The physical printer is called a print device
  - The printer is a program that controls one or more print devices
  - One printer can support more than one print device

**Setting Up Printers**

- **Open the Printers applet**
  - Windows XP: Start ➔ Printers and Faxes
  - Windows 9x, Me, NT, 2000: Start ➔ Settings ➔ Printers
  - Or find it in Control Panel
- **Click the Add Printer icon to start the Add Printer Wizard**
Adding a Printer

Default Printer

Troubleshooting Printers

General Troubleshooting Issues

- **Job never prints**
  - Is the printer on? Is it connected? Does it have paper?
  - Check the spooler status by double-clicking the printer’s icon in the System Tray or in the Printers applet

- **Strange sizes**
  - A mistake in setting up the page properly – check the Page Setup option in the application

- **Misaligned or garbage prints**
  - A corrupted or incorrect driver – reinstall
  - You may have asked the printer to do something it can’t such as printing Postscript with a PCL driver

Dealing with Consumables

- **Printer components should be properly disposed to avoid environmental hazards**
  - The Material Safety Data Sheet (MSDS) form provided by the manufacturer contains detailed information about the potential environmental hazards associated with the different components, and their proper disposal methods
Other Issues

• Sharing multiple printers
  - A mechanical switch box may be used to share multiple printers
  - Laser printers should only be used with electronic switch boxes

• Crashes on power up
  - Printers require a lot of power on start up
  - HP recommends that you turn on the laser printer first and then the PC

Troubleshooting Dot Matrix Printers

• Dot Matrix printers require regular maintenance
  - The printhead and the platen should be cleaned with denatured alcohol to prevent problems like white bars on text, dots and smudges on paper, etc.
  - Gears and pulleys should be lubricated according to the manufacturer’s specifications

• Bad-looking text
  - Dirty or damaged printhead
  - Clean with denatured alcohol or replace

• Bad-looking page
  - Clean the platen with denatured alcohol
  - Replace the ribbon

Troubleshooting Inkjet Printers

• Use the maintenance software that came with the printer setup program
  - Align the printheads
  - Clean the printheads
    • Ink will dry out in a short time if an inkjet printer is not used – the ink in the tiny nozzles of the printhead dries out
  - Multi-sheet grab
    • Fan the paper
    • Let the printer rest if you’ve been printing a lot
    • Humidity can be an issue
  - Clean the small tank where the printhead rests or parks with a paper towel

• Excess toner and paper dust are common causes of the printer getting dirty
  - Clean with a special low-static vacuum designed for electrical components or a can of compressed air
  - The rubber guide rollers will pick up dirt and paper dust over time which causes paper jams
  - Clean with Formula 409 or a little water

• Hewlett Packard sells maintenance kits for most of their printers

Laser Printer Maintenance

• Printer components such as the ozone filter, fuser assembly, transfer corona, paper guides/rollers, and thermal fuse should be replaced periodically

• Refer to the service manual for other maintenance procedures

Troubleshooting Laser Printers

• Print a diagnostic print page or engine print page by holding down the On Line button as the printer is started as a first-step in troubleshooting

• Blank paper
  - Out of toner
  - Print a diagnostic page, remove the toner cartridge and look at the imaging drum – if there is an image there, the transfer corona or high-voltage power supply is bad
### Troubleshooting Laser Printers

- **Dirty printouts**
  - Light dusting of toner all the paper (front or back) - clean the printer

- **Vertical white lines**
  - Clogged toner - try shaking the toner cartridge or replacing it

- **Ghosting**
  - Results from having printed a complex or very dark page that used so much toner that the printer isn’t prepared for the next page
  - Low temperature or low humidity
  - Dark ghosting may indicate a damaged drum – replace the toner cartridge

- **Blotchy print**
  - Uneven dispersion of toner – try shaking the toner cartridge from side to side
  - Make sure the printer is level
  - Make sure the paper is not wet in spots
  - Check the fusing rollers and photosensitive drum for foreign objects

- **Light ghosting**
  - Caused by printing an extremely dark or complex image
    - Lower the resolution
    - Use different pattern
    - Avoid 50% grayscale and dot-on/dot-off patterns
    - Print in landscape
    - Adjust print density
    - Print a completely blank page before the next one

- **Spotty print**
  - Try wiping off the fuser rollers
  - Check the drum for damage

- **Embossed effect**
  - Like putting a penny under a piece of paper and rubbing it with a lead pencil
  - A foreign object on a roller
  - A foreign object on the photosensitive drum – replace the toner cartridge

- **Incomplete characters**
  - These may occur on transparencies – try adjusting the print density

- **Creased pages**
  - Try using a different paper type – cotton bond paper is more susceptible

- **Paper jams**
  - If there is no jammed paper, then one of the jam sensors or paper feed sensors is bad
  - Do not pull on the paper to remove it – check the manual for the proper way to remove a jammed piece of paper
  - Clean the rollers
### Troubleshooting Laser Printers

<table>
<thead>
<tr>
<th><strong>Pulling multiple sheets</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>– Try using a different ream of paper – if that works the issue is humidity</td>
</tr>
<tr>
<td>– Check the separation pad – a small piece of rubber or cork that separates the sheets as they are pulled from the paper tray</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Warped, overprinted, or poorly formed characters</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>– Paper that is too rough or too smooth</td>
</tr>
<tr>
<td>– Don’t open a ream of paper until it is loaded into the printer</td>
</tr>
<tr>
<td>– Always fan the paper before loading it in the printer</td>
</tr>
<tr>
<td>– Do a printer self-test to determine if it is the printer or the computer</td>
</tr>
<tr>
<td>– Replace the toner cartridge, check the cabling, replace the data cable</td>
</tr>
<tr>
<td>– Turn off advanced functions and high speed settings to see if they may not be supported by your software configuration</td>
</tr>
</tbody>
</table>

### DOT4

<table>
<thead>
<tr>
<th><strong>Also called IEEE 1284.4 standard</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Created for Multifunction peripherals (MFP)</strong></td>
</tr>
<tr>
<td>– Devices that combine printer, fax, and scanner in one piece of equipment</td>
</tr>
<tr>
<td><strong>Allows simultaneous sending and receiving across a single physical channel</strong></td>
</tr>
</tbody>
</table>