PRINTERS

The number of printer options available is staggering. Not only are there many brands with endless features there is also a vast array of applications. You not only need to know what the printer can accomplish you need to take the time to determine what you need the printer to do. Then there are the issues of print quality, reliability, warranty, service, cost, and maintenance.

Key Terms

- **DPI** – is a measure of spatial printing or video dot density, in particular the number of individual dots that can be placed in a line within the span of 1 inch. The DPI value tends to correlate with image resolution
- **Image Resolution** - describes the detail an image holds. The term applies to digital images, film images, and other types of images. Higher resolution means more image detail.
- **PPM**- Pages Per Minute - The speed of early printers was measured in units of characters per second. More modern printers are measured in pages per minute. These measures are used primarily as a marketing tool, and are not as well standardized as toner yields. For purposes of selecting a printer PPM is easier to understand than toner yields. Usually PPM refers to sparse monochrome office documents, rather than dense pictures which usually print much more slowly, especially color images. PPM are most of the time referring to letter paper.
- **Inkjet Printer** - is a type of computer printer that reproduces a digital image by propelling variably-sized droplets of liquid material (ink) onto a page. Inkjet printers are the most common type of printer and range from small inexpensive consumer models to very large and expensive professional machines.
- **Laser Printer** - is a common type of computer printer that rapidly produces high quality text and graphics on plain paper. As with digital photocopiers and multifunction printers (MFPs), laser printers employ a xerographic printing process but differ from analog photocopiers in that the image is produced by the direct scanning of a laser beam across the printer's photoreceptor.
- **Multifunction Priner (MFP)** - Multifunction Device (MFD), is an office machine which incorporates the functionality of multiple devices in one, so as to have a smaller footprint in a home or small business setting, or to provide centralized document management/distribution/production in a large-office setting. A typical MFP may act as a combination of some or all of the following devices: Printer, Scanner, Photocopier, Fax, and E-Mail
- **Spooling** - documents formatted for printing are stored onto a buffer (usually an area on a disk) by a fast processor and retrieved and printed by a relatively slower printer at its own rate. As soon as the fast processor has written the document to the spool device it has finished with the job and is fully available for other processes. One or more processes may rapidly write several documents to a print queue without waiting for each one to print before writing the next. Spooler or print management software may allow priorities to be assigned to jobs, notify users when they have printed, distribute jobs among several printers, allow stationery to be changed or select it automatically, generate banner pages to identify and separate print jobs, etc.
- **Driver or a print processor** - is a piece of software that converts the data to be printed to the form specific to a printer. The purpose of printer drivers is to allow applications to do printing without being aware of the technical details of each printer model.
- **Ethernet** - is a family of frame-based computer networking technologies for local area networks (LANs). A Local Area Network is a computer network covering a small physical area, like a home, office, or small groups of buildings, such as a school, or an airport. The defining characteristics of LANs, in contrast to wide area networks (WANs), include their usually higher data-transfer rates, smaller geographic area, and lack of a need for leased telecommunication lines.
- **USB** - is a specification to establish communication between devices and a host controller (usually personal computers). USB is intended to replace many varieties of serial and parallel ports. USB can connect computer peripherals such as mice, keyboards, digital cameras, printers, personal media players, flash drives, and external hard drives. For many of those devices, USB has become the standard connection method. USB was designed for personal computers, but it has become commonplace on other devices such as Smartphones, PDAs and video game consoles, and as a power cord between a device and an AC adapter plugged into a wall plug for charging.
- **CMYK** - is a subtractive color model, used in color printing, and is also used to describe the printing process itself. CMYK refers to the four inks used in some color printing: cyan, magenta, yellow, and keyblack. Though it

varies by print house, press operator, press manufacturer and press run, ink is typically applied in the order of the abbreviation.

The CMYK model works by partially or entirely masking colors on a lighter, usually white, background. The ink reduces the light that would otherwise be reflected. Such a model is called subtractive because inks "subtract" brightness from white.

Printer Uses

- Home User: The home user demands a lot from a printer. The device must tackle everything from a book report to a newsletter to the occasional snapshot--all without breaking the budget. This is why for most home users, the best choice is a versatile and affordable printer, such as a small-office/home-office color inkjet. These printers cost anywhere from $50 to $150 and are designed to do a little of everything, albeit slowly.
- Professional Writer or College Student: A personal laser printer may be the best option. It can deliver large amounts of crisp, legible text, fast. Personal laser printers start at around $200 or so, but they cost less to operate than inkjets do, so you can save money over the life of the printer. Inexpensive, personal lasers are also a good option for college students busy churning out term papers.
- Photographer: Any inkjet can print photos in color, but if you want results that approach professional photofinishing, you'll need a printer that is designed to reproduce the dynamic range of photographs. If you're in the market for an enthusiast printer, you need to look at the gamut and characteristics of the ink set, the supported papers, and the color-management tools. If you plan to purchase only one printer or are a serious hobbyist, a letter-size inkjet is your best bet, since it can also handle routine printing tasks. Many use thermal dye-transfer technology (also known as dye sublimation) in which heat changes the physical state of solid inks until they infuse specially coated paper, solidifying as they cool. Snapshot printers can print directly from compatible digital cameras.
- Small Business: If you work from a home office frequently or run a small business, a multifunction printer (MFP) is an excellent choice. Also known as all-in-ones (AIOs), these multitalented devices combine an inkjet or a laser printer with a copier, a scanner, and a fax machine. They save both space and money. Though inkjet models start as low as $100, for slightly more you can purchase a model that includes standalone faxing and has an auto document feeder (ADF) for easily faxing and copying multipage documents
- Corporate: If you need a workhorse that can keep up with your small business or team within a larger organization, a workgroup laser printer is an obvious choice. Designed to juggle multiple print jobs, these systems have faster processors, more memory, and print engines that are capable of churning out more than 20 pages per minute. But these $400-and-up printers are more than souped-up personal lasers; they offer workgroup features, such as network printing, high-capacity toner cartridges, and larger paper input and output trays.
- On the Move: If you really need to take the whole office in your notebook bag, there's a printer out there for you. Portable printers shrink inkjet printing down into a convenient travel size. They weigh anywhere from 2 to 5 pounds and typically come with a battery (either standard or as an option) or a car charger for printing on the go. Some manufacturers are even adding support for printing wirelessly from a cell phone.

Available Options

- Personal Laser: laser printers are a good choice because they combine fast print speeds, sharp output, and a low cost per page. Like copiers, laser printers use a photographic drum to attract electrically charged toner and transfer it to paper, where the image is fused using a heated roller. The vast majority of laser printers are monochrome (black and white), and they are best-suited for printing text and simple graphics. They start around $200. Until recently color laser printers were too expensive for individuals or small businesses, but there are now several models for less than $500, and these are viable alternatives to color inkjets for printing flyers, spreadsheets, and brochures. More manufacturers also offer networking--either built-in or as an add-on--on personal lasers, making them a good fit for homes with multiple users and PCs.

  Key Features:
  - Interface: USB, Parallel, and Ethernet

- Resolution: 600x600 dpi and up
- Rated Speed: 10 to 20 ppm
- Memory: 32MB or more
- Paper Capacity: 150 to 250 sheets

- Workgroup Laser: As the name implies, workgroup laser printers are designed for small offices or small teams within larger companies. The basic technology is the same, but these are more than beefed-up personal lasers with features tailored specifically for multiple users. First, they support printing over networks either standard or as an option. Second, they offer more-advanced handling capabilities, including larger input and output trays, and some offer duplex (double-sided) printing, sorting, and stapling. Finally, they have faster processors and more memory so that they can manage multiple jobs and print faster. Like personal lasers, the vast majority of workgroup lasers are monochrome--designed for printing text and simple graphics--and they start at around $400.

  Key Features:
  - Interface: USB, Parallel, and Ethernet
  - Resolution: 600x600 or 1200x1200 dpi
  - Rated Speed: More than 20 ppm
  - Memory: 64MB or more
  - Paper capacity: 250 sheets or more

- Inkjet: Today's versatile inkjets can produce both crisp text and rich photo prints. Most manufacturers offer both general-purpose and photo inkjet printers, which shouldn't be confused with snapshot or photo printers designed for only 4x6 or smaller prints. Inkjets print an image by applying a precisely controlled stream of tiny ink droplets from one or more cartridges to a variety of paper types. Each manufacturer uses slightly different techniques, and the size of the droplets and the way they are applied to the paper determine the image quality. Unfortunately, the process is relatively slow compared to that of laser printing--and the ink cartridges and the special papers can be costly--so inkjets are best suited for home users and small businesses with light printing needs, or those who need to produce high-quality graphics and photos. Inkjet printers range in price from less than $100 to as much as $800, depending on features, image quality, and paper-handling capabilities.

  Key Features:
  - Interface: USB, parallel, Ethernet
  - Resolution: Varies widely by manufacturer and model
  - Rated Speed: 5 to 20 ppm
  - Memory: Measured in KB
  - Paper Capacity: 100 sheets or more

- Multifunction/ All-in-one: Multifunction printers (MFPs) or all-in-ones (AIOs) combine copier, scanner, printer, and, in some models, fax capabilities in one unit, making them perfect for home offices and small businesses. MFPs are available with either laser printers for speedy text and occasional graphics, or inkjet printers for vibrant photos. The best models include flatbed scanners and auto document feeders for walk-up scanning, faxing, and copying of multipage documents. MFPs start at around $100 for entry-level inkjets, but the price ranges vastly depending on printer technology and feature set.

  Key Features:
  - Interface: USB, Ethernet
  - Resolution: Depends on printer technology
  - Rated Speed: Depends on printer technology
  - Memory: 32MB and up
  - Paper Capacity: 100 sheets or more

- Photo / Snapshot: Some inkjet printers use more than the four basic CMYK inks to produce high-quality photos, so if you own a digital camera and spend a lot of time printing photos, you may want to pay a little more than

a plain old inkjet will cost or opt for a second printer specifically for that purpose. Some photo printers use inkjet technology, described above, but most rely on dye-sublimation, which transfers color dye in a continuous tone from a ribbon onto the paper in a series of passes, followed by a protective clear coating. The print quality is comparable to that of professional photofinishing. Another big advantage: they can print directly from compatible digital cameras, and most models also accept storage cards such as CompactFlash, SmartMedia, Secure Digital/MultiMediaCard, or Memory Stick. A subclass of photo printers, or snapshot printers, is limited to 4x6 or smaller prints; they can't handle standard 8.5x11 sheets, which is why they are suitable as second printers only. They typically cost at least $200.

Key Features:

- Interface: Media card slots, PictBridge, USB
- Resolution: Varies by technology
- Rated Speed: Varies by technology
- Memory: Measured in KB, not MB
- Paper Capacity: Varies by technology

- Portable: These printers are designed for life on the road. They weigh anywhere from 2 to 5 pounds and are just large enough to squeeze through a standard 8.5-inch-wide sheet of paper. Portable printers use the color-inkjet-printing technology . The print speeds and the image quality are hardly top-notch, and you'll pay a premium for these travel partners, but if you really need to print on the go, they fit the bill. They typically cost $300 or more.

  Key Features:

  - Interface: USB
  - Resolution: Varies by manufacturer
  - Rated Speed: Less than 10 ppm
  - Memory: Minimal
  - Paper Capacity: Ranges from a few sheets to 50 sheets standard input

Understanding the Specs

When evaluating printers the first thing you will see is a long list of confusing specifications. These specs are not only confusing, but they often have little or no bearing on the performance of the printer under general use. The following is a description and information regarding specs you will usually encounter.

- Resolution: the resolution refers to the maximum number of dots per inch (dpi) that can be printed, measured both horizontally and vertically. For example, a 600x600 dpi laser printer lays down a one-inch square composed of 600 dots across by 600 dots down. In theory, a printer with a higher resolution is capable of producing more-detailed text and images.
  Though manufacturers have inflated the numbers for marketing purposes, and the numbers no longer correlate directly with higher image quality, resolution still has some bearing on the quality of text and curves, especially on premium papers.
- Print Speeds: This spec measures how many pages or photos per minute (ppm) a printer spits out. Sounds pretty straightforward, unfortunately, it's not so simple. To come up with the fastest-possible speeds, some manufacturers test using basic text documents at the lowest-quality print settings (Draft mode) on plain paper--not exactly a real-world test. You can often expect to see about half the speed promised by the manufacturer.
- Connectivity: The USB (Universal Serial Bus) is truly universal--all printers now have a USB 2.0 port. Workgroup printers also support printing over a network using a standard Ethernet cable with an RJ-45 connector. For even better mobility, many models support printing wirelessly, using infrared, Bluetooth, and Wi-Fi access points with built-in print servers.
- Processor memory: Nearly all laser printer manufacturers provide information on the processor and the memory, but at least for personal use, these specs are relatively unimportant. Your computer does a fine job, largely on its own, of lining up print jobs and sending them on to be printed. If you have multiple users or you often print high-resolution photos or other large files, however, then you'll want a printer with a faster processor

and more onboard memory.

- Paper handling: The typical paper-handling specs on a printer include everything from the size and thickness of various types of paper to the standard and optional input- and output-tray capacity. Generally, all inkjets and personal laser printers print on standard paper (letter and legal sizes), accept envelopes, and have input and output trays that hold at least 100 sheets, except for snapshot and portable models. More advanced paper-handling features--such as tabloid-size printing, duplexing (printing on both sides), and auto document feeders for faxing and copying--will be found on only higher-end models.

Judging Print Quality

The cardinal rule of purchasing a printer is to print before you pay. Otherwise, there's no surefire way to tell exactly how text and images will appear. Fortunately, many retail stores let you print demonstration pages to get a feel for the output quality. Here are some things to watch for, courtesy of CNET Labs.

- Text: Most demonstration pages will include rows of text at varying sizes, which can show different types of flaws. At the smallest font sizes, the individual letters should be legible and fully formed with no breaks, and they should not bleed into one another. Medium-size fonts should be crisp with no fuzzy edges. And the largest fonts, especially bold ones, should be filled in with a solid, even black--not a muddy bluish or brownish tone. If the tops and bottoms of characters are slightly offset or you see a pattern of dots incorrectly aligned from one row to the next (forming jagged outlines), that typically indicates misregistration of the printhead. You should also be able to see well-rounded counters (the openings) in letterforms; if not, that's usually a sign of the printer laying down too much ink. Keep in mind that on plain, 20-lb. paper, inkjet printers will usually display some wicking, as the ink bleeds along the paper fibers.
- Graphics: The printer demonstration should print several geometric shapes of different sizes and shading. The outlines should be crisp with smooth curves; inside areas of solid colors should appear dense and evenly shaded. Also look for areas where a color goes from dark to light (a gradient). Is it a smooth transition, or can you see color banding, distinct bands progressing from darker to lighter? Large areas of flat color should appear solid and even, rather than muddy. Some printers try to dazzle the eye with overly saturated colors; others skimp on ink, leaving images that appear washed out. Look for a nice, natural-looking balance between the two. Printhead banding--that is, visible horizontal stripes across a page--could be caused by a clogged nozzle, a poorly aligned bidirectional printhead, or a poor rendering algorithm (gradients aren't rendered smoothly).

Photos

When evaluating photo print quality, there are four chief considerations:

- Color accuracy: Compared to the original, the colors should be accurate, pleasing, and well balanced. Colors should be vivid but not oversaturated. Look at a monochrome photo under fluorescent light, incandescent light, and daylight. How badly does the color cast change from one light to another (called metamerism)? Be sure to look for inconsistencies across different paper types and print resolutions.
- Sharpness: Is the output sufficiently sharp? Any jaggies? If you see problems, do you have any theories about what's going on? Does the lack of sharpness have to do with printhead or color misregistration?
- Dynamic range: Can you see detail in highlight and shadow areas, or are they rendered as flat or with no color? Does the printout look muddy or low contrast?
- Artifacts: Do you see any banding? How about evidence of a clogged nozzle? Excessive dot gain? Any other weird stuff going on?

The Real Cost of a Printer

The prices of personal printers look pretty enticing, especially those sub-$100 models. But keep in mind that the purchase price is just the start: the care and feeding of a printer can quickly exceed the original cost. Before pulling out your credit card, be sure to compare the costs of consumables.

- Ink and toner: Inkjets are the least expensive printers available, with many models starting at less than $100. The catch? The consumables, such as replacement inks and specialty papers, can cost you an arm and a leg. Ink typically costs between $12 and $60 per cartridge and can last for 100 to 200 pages. More expensive printers,

however, tend to be more economical to operate because they have higher-capacity ink tanks and separate ink tanks for each color so that you don't need to replace everything when only one color runs dry. To save some money, you can purchase a compatible ink-refill kit from a separate company, though you may not get the same reliability or print quality.

Laser toner cartridges vary greatly in price, yield, and print capabilities. Toner cartridges generally cost from $10 for a small cartridge for a personal laser printer to as much as $300 for a high-capacity cartridge for a networked workgroup laser printer. Toner costs seem high, but so is the yield. A cartridge typically prints between 2,500 and 10,000 pages (although some claim to print as many as 30,000), so the cost per page is a few pennies for text (at 5 percent coverage) and not much more for images (with 15 percent coverage). Pay attention to the expiration dates, though; some cartridges (HP's in particular) will stop working at a set time, no matter how much ink is left. Also, consider paying a little more for a separate toner cartridge and drum kit, rather than the usual combination unit. That way, you don't have to replace the drum, which is often capable of handling many more print jobs, every time you replace the toner.

Dye-sublimation printers have the advantage of a fixed cost per print, since each print eats up the identical amount of ribbon, regardless of photo content. On the other hand, the prices for packs of ribbons and paper can be exorbitant, sometimes as much as $2 per photo.

- Paper: If there's one thing we've learned from CNET Labs' extensive printer testing, it's that better-quality paper yields better-quality printouts. For the best results, you really need to bite the bullet and buy the coated or specialty paper recommended by the manufacturer of your model. This is particularly true for inkjets, photo printers, and multifunction devices. Special paper can cost 10 cents to $2 per letter-size sheet, but it is essential if you want to print crisp-looking text or high-resolution photos.
- Extras: The biggest gotcha with many printers is the printer cable. Incredibly, many manufacturers don't even include one because retailers want to sell you one separately for anywhere from $10 to $30. Before leaving the store, read the box to determine whether you'll need to buy one separately. For some business inkjets and laser printers, network connectivity is optional, as well.

  If you're purchasing a workgroup printer or an advanced multifunction printer, you should also consider some paper-handling features that are frequently offered as add-ons, such as larger-capacity input trays; output bins for collating, stapling, and other finishing options; and auto documents feeders for copying and faxing multipage documents.

References and Resources

http://reviews.cnet.com/2719-7604_7-276-2.html?tag=page;page