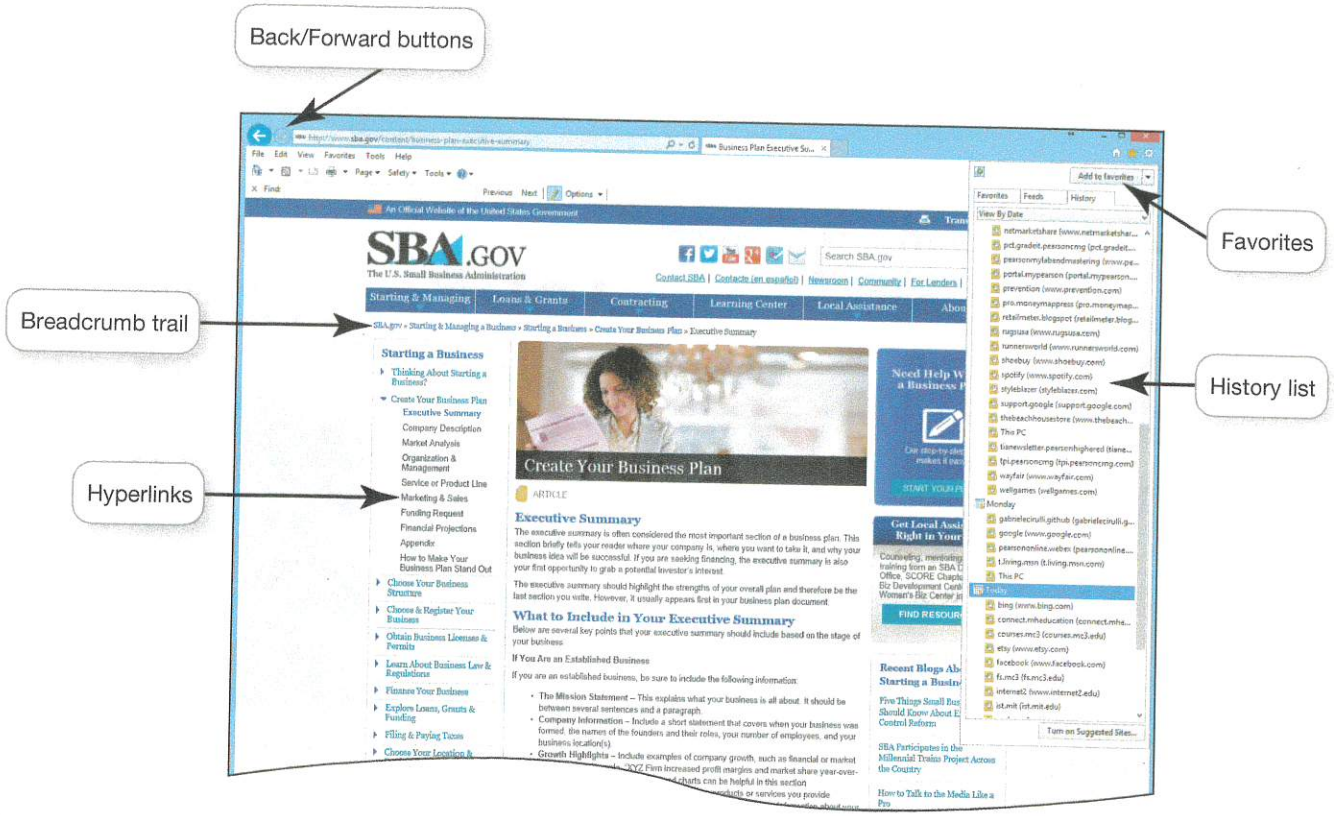


FIGURE 3.19 Navigating a Web Page *(U.S. Small Business Administration)*

within the website. In Figure 3.16, you would connect to the crossword page on the *New York Times* site.

Hyperlinks and Beyond

What's the best way to get around in a website? As its name implies, the web is a series of interconnected paths, or links. You've no doubt moved around the web by clicking on **hyperlinks**, specially coded elements that let you jump from one web page to another within the same website or to another site altogether (see Figure 3.19). Generally, text that operates as a hyperlink appears in a different color (often blue) and is usually underlined, but sometimes images also act as hyperlinks. When you hover your cursor over a hyperlink, the cursor changes to a hand with a finger pointing upward.

What other tools can I use to navigate a website? To move back or forward one page at a time, you can use the browser's Back and Forward buttons (see Figure 3.19).

To help navigate more quickly through a website, some sites provide a **breadcrumb trail**—a navigation aid that shows users the path they have taken to get to a web page, or where the page is located within the website. It usually appears at the top of a page. Figure 3.19 shows an example of a breadcrumb trail. "Breadcrumbs" get their name from the fairy tale "Hansel and Gretel," in which the characters drop breadcrumbs on the trail to find their way out of a forest. By clicking on earlier links in a breadcrumb trail, you can go directly to a previously visited web page without having to use the Back button to navigate back through the website.

The History list on your browser's toolbar is also a handy feature. The History list shows all the websites and pages you've visited over a certain period of time. These sites are organized according to date and can go back as far as three weeks, depending on your browsing activity. To access the History list in Internet Explorer, click the star in the upper right-hand corner of the browser window and then click the History tab.

SOUND BYTE

Welcome to the Web

In this Sound Byte, you'll visit the web in a series of guided tours of useful websites. This tour serves as an introductory guide for web newcomers but is also a great resource for more experienced users.

FIGURE 3.20 Delicious is a social bookmarking website that allows you to organize and share your favorite websites. *(Delicious Science, LLC, www.delicious.com)*

Favorites, Live Bookmarks, and Tagging

What's the best way to mark a site so I can return to it later? If you want an easy way to return to a specific web page, you can use your browser's **Bookmarks** feature (Internet Explorer calls this feature **Favorites**). This feature places a marker of the site's URL in an easily retrievable list in your browser's toolbar. To organize the sites into categories, most browsers offer tools to create folders.

Favorites and Bookmarks are great for quickly locating those sites you use most, but they're accessible to you only when you're on your own computer. Although most browsers provide features that let you export the list of bookmarks to a file you can import to another computer or another browser, another way to access your Bookmarks and Favorites from any computer is to use MyBookmarks (**mybookmarks.com**), a free Internet service that stores your Bookmarks and Favorites online.

What are live bookmarks? Live bookmark is a feature in Firefox that adds the technology of RSS feeds to bookmarking. Safari and Internet Explorer also have built-in RSS readers, while Chrome requires that you add on an extension. Because the web is constantly changing, the site you bookmarked last week may subsequently change and add new content. Traditionally, you would notice the change only the next time you visited the site. Live bookmarks deliver content updates to you as soon as they become available using RSS, the same technology that updates blogs and podcasts that we described earlier in the chapter. Live bookmarks and RSS feeds are useful if you're interested in the most up-to-date news stories, sports scores, or stock prices.

What is tagging? Tagging, also known as **social bookmarking**, is like bookmarking your favorite website, but instead of saving it to your browser for only you to see, you're saving it to a social bookmarking site so that you can share it with others. A social bookmark or tag is a **keyword** or term that you assign to a web page, digital image, or video. A tag can be something you create to describe the digital content, or it can be a suggested term provided by the website. For example, as you were surfing the web you came across a web page with a great article on inexpensive places to go for spring break. You might tag the article with the term *vacations*. Others on the same social bookmarking site who are looking for websites about vacations may use *vacations* as the search term and find the article you tagged.

Delicious (**delicious.com**) is one of the original social bookmarking sites (see Figure 3.20). Delicious lets you group related links and organize them into "bundles." So if you've collected several links to websites about different places to go to over spring break, you can collect all those links into one bundle about vacations. Or if you want to see what links others may have found about interesting vacations, you could search Delicious with the term *vacations* to see other vacation-related bundles.

Another social bookmarking site is Diigo (**diigo.com**). Diigo differs from Delicious by allowing you to annotate the pages with highlights and sticky notes. Through Diigo, you can archive web pages so they are always available. ■

trends in IT

Doing Business on a Shoestring—Thanks to the Internet

Let's say you think that flip-flops in school colors would be a popular product. Your school's bookstore carries everything else with the school's colors and logo, but not flip-flops. You've asked your friends and several classmates, and most of them say they would buy flip-flops in the school's colors. So what do you do next? How do you move from product concept to selling a physical product?

Before the Internet, it would have been much more difficult and expensive to get your product produced and distributed. First, you would have had to find someone to design your flip-flops. Then, to make the flip-flops, you would have had to find a manufacturer, who may have required a high minimum order (maybe tens of thousands of pairs of flip-flops). You also would have needed a package design, marketing brochures, a company logo, a storage facility, and more. Finally, the largest hurdle would have been to convince a brick-and-mortar retailer, such as your campus bookstore, to carry your product.

Today, however, the Internet brings the power of the global economy right to your door (see Figure 3.21). For product design and manufacturing, you can visit a site like Alibaba (**alibaba.com**), which helps entrepreneurs locate manufacturers of all sorts of products. Many manufacturers are happy to work with small business owners to custom-design products. So if you find a flip-flop style you like, you probably can get it customized with your school colors.

But what happens if the bookstore doesn't want to sell your flip-flops? If this happens, you can set up a website to sell them yourself. Of course, you may need help doing this, in which case you can locate skilled professionals by using sites such as Guru (**guru.com**) or Elance (**elance.com**). You simply create a description of the job you need done (such as logo design for a flip-flop company), post it on the site, and invite freelancers to bid on your job. You then contact the freelancers who look promising, review samples of their work, and decide on someone who can help you—and at a competitive price. After your website is designed and up and running, you can place your business on social networking sites, such as Facebook, to help potential customers discover your product and spread the word about your great flip-flops. You probably already have lots of friends on Facebook who attend your school and would be good potential customers.

Another hurdle is determining where you'll store your product and who will package and ship it to customers. If your parents' basement isn't large enough, you can outsource warehousing and order fulfillment to **Amazon.com**. Amazon will (for a fee) warehouse your inventory and then package and ship it when customer orders are received. Orders don't have to come through Amazon's site (although that is an option); you can provide ordering information collected on your site to Amazon, and Amazon will take care of the rest.

Although there is always a cost to starting up a business, up-front costs are much lower when you take advantage of the global marketplace and the Internet. So, take that brilliant idea you have and turn it into a business today!

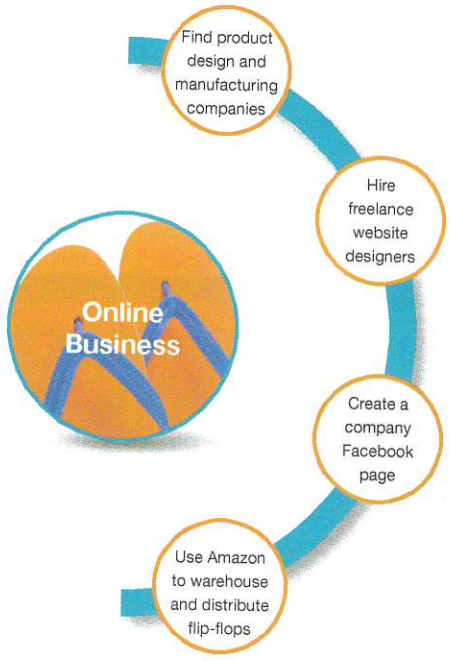


FIGURE 3.21 By using the services of only a few websites, you can create and distribute products, such as your own line of custom flip-flops.

searching the web EFFECTIVELY

You've most likely "Googled" something today, and if you did, your search is one of over five billion daily searches. Google is the world's most popular **search engine**—a set of programs that searches the web for keywords (specific words you wish to look for or *query*) and then returns a list of the sites on which those keywords are found. In fact, Google has become so popular that its name is synonymous with looking for information on the web. Other popular search engines include Yahoo!, Bing, and Ask.com. But there are even more options for searching the web.

For some web searches, it might be better to use a **subject directory**, which is a structured outline of websites organized by topics and subtopics. By drilling down through the topics and subtopics, you can narrow down to a list of meaningful websites to look through. For example, if you wanted to know about exhibits of 3-D photography, you might click Arts>Visual Arts>Photography>3-D>Exhibits in a subject directory. In Yahoo's subject directory (**dir.yahoo.com**), the result would be a list of relevant websites about 3-D photography exhibits. The website ipl2 (**ipl2.org**) has a subject directory that combines resources from the Internet Public Library and the Librarians' Internet Index websites (see Figure 3.22). (ipl2 also has a feature through which you can ask a librarian a question.)

If you can't decide which search engine is best, you may want to try a metasearch engine. **Metasearch engines**, such as Dogpile (**dogpile.com**), search other search engines rather than individual websites. Figure 3.23 lists search engines and subject directories that are alternatives to those you might use most often.

Using Search Engines Effectively

How do search engines work? Search engines have three components:

1. The first component is a program called a *spider,* which constantly collects data on the web, following links in websites and reading web pages. Spiders get their name because they crawl over the web using multiple "legs" to visit many sites simultaneously.
2. As the spider collects data, the second component of the search engine, an *indexer program*, organizes the data into a large database.
3. When you use a search engine, you interact with the third component: the *search engine software*. This software searches the indexed data, pulling out relevant information according to your search.

The resulting list appears in your web browser as a list of hits—sites that match your search.

Why don't I get the same results from all search engines? Each search engine uses a unique formula, or *algorithm*, to formulate the search and create the resulting index of related sites. In addition, search engines differ in how they rank the search results. Most search engines rank their results based on the frequency of the appearance of your queried keywords in websites as well as the location of those words in the sites. This means that sites that include the keywords in their URL or site name will most likely appear at the top of the results list. An important part of a company's marketing

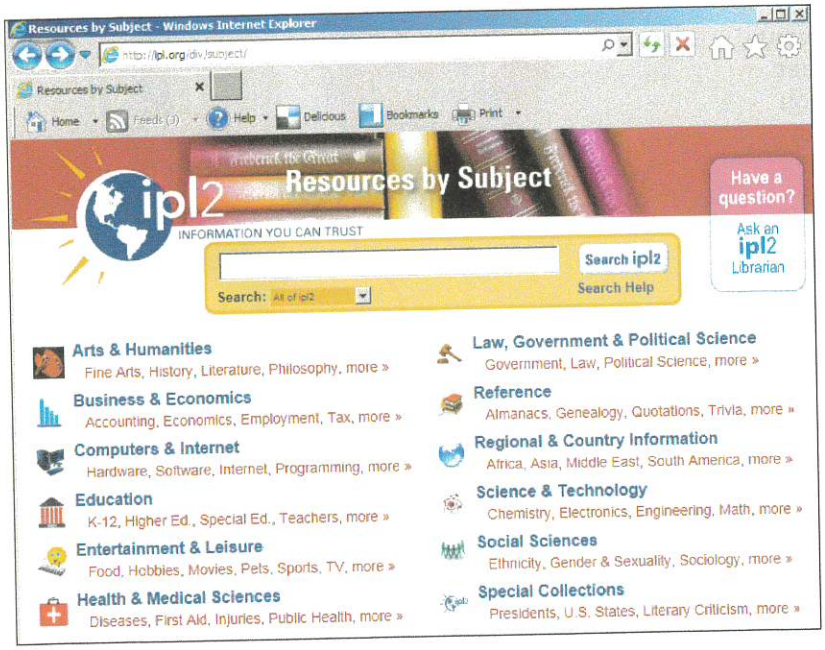


FIGURE 3.22 There are good alternatives to Google. ipl2 (**ipl2.org**) is a subject directory that lists resources by subject. Other alternatives are metasearch engines and specialty search engines.

FIGURE 3.23

Alternative Search Engines and Subject Directories

Bing **bing.com**	Web search engine from Microsoft
BrightPlanet **brightplanet.com**	"Deep web" directory that searches databases not normally searched by typical search engines.
ChaCha **chacha.com**	Uses live people who help you search; free of charge. Also available by texting your questions to 242242.
Dogpile **dogpile.com**	Metasearch engine that searches Google, Yahoo!, and Bing.
Excite **excite.com**	Website that in addition to having keyword search capabilities includes subject directory links to information on a wide variety of topics including travel, weather, concert tickets, and top news items.
Info.com **info.com**	Metasearch engine that searches Google, Yahoo!, Bing, and Yandex (a Russian search engine).
InfoMine **infomine.com**	Subject directory of academic resources with keyword search engine capabilities.
ipl2 **ipl2.org**	Subject directory that combines resources from the Internet Public Library and the Librarians' Internet Index websites.
Google Images **google.com/images**	Visual search engine that displays images rather than text as a result of a keyword search.
Open Directory Project **dmoz.org**	Human-edited subject directory with keyword search capabilities. Maintained by a global community of volunteer editors.
Yippy **yippy.com**	Metasearch engine that groups similar results into topics called clusters (for example, NBA, College Basketball, Photo Gallery, and Articles would be some resulting clusters if you use the search term *basketball*). Clicking on any of these clusters results in listing those sites specific to that subset of basketball.

Note: For a complete list of search engines, go to **searchengineguide.com**

strategy is search engine optimization, which is designing the corporate website to ensure it ranks near the top of a search.

Search engines also differ as to which sites they search. For instance, Google and Bing search nearly the entire web, whereas specialty search engines search only sites that are relevant to a particular topic or industry. Specialty search engines exist for almost every industry or interest. DailyStocks (**dailystocks.com**) is a search engine used primarily by investors that searches for corporate information. Search Engine Watch (**searchenginewatch.com**) has a list of many specialty search engines, organized by industry.

Can I use a search engine to search just for images and videos? With the increasing popularity of multimedia, search engines such as Google, Bing, and Yahoo! let you search the web for digital images and audio and video files. After putting in your search term, select Video from Google's top menu to display only the search results that are videos. You can further narrow down the video selection by using the filtering tools. Blinkx (**blinkx.com**) is a video search engine that helps you sift through all the video posted on the web (see Figure 3.24).

How can I refine my searches for better results? You've probably searched for something on Google and gotten back a list of hits that includes thousands—even millions—of web pages that have no relevance to the topic you're interested in. Initially, Boolean operators were needed to help refine a search. **Boolean operators** are words such as *AND, NOT,* and *OR* that describe the relationships between keywords in a search. With the simple addition of a few words or constraints, you can narrow your search results to a more manageable and more meaningful list.

Are there other helpful search strategies? Other strategies can help refine your searches when entering your search keywords:

- **Search for a phrase.** To search for an exact phrase, place quotation marks around your keywords. The search engine will look for only those websites that contain the words in *that exact order*. For example, if you want information on the movie *The Green Hornet* and you type these words without

ACTIVE HELPDESK

Getting Around the Web

In this Active Helpdesk, you'll play the role of a helpdesk staffer, fielding questions about web browsers, URLs, and how to use hyperlinks and other tools to get around the web.

quotation marks, your search results will contain pages that include either of the words *Green* and *Hornet*, although not necessarily in that order. Typing *"The Green Hornet"* in quotation marks guarantees that search results will include this exact phrase.

- **Search within a specific website.** To search just a specific website, you can use the search keyword, then *site:* followed by the website's URL. For example, searching with *processor site:* www.wired.com returns results about processors from the Wired.com website. The same method works for entire classes of sites in a given top-level domain or country code.
- **Use a wild card.** The asterisk ("*") is a wild card, or placeholder, feature that is helpful when you need to search with unknown terms. Another way to think about the wild card search feature is as a "fill in the blank." For example, searching with *Congress voted * on the * bill* might bring up an article about the members of Congress who voted *no* on the *healthcare* bill or a different article about the members of Congress who voted *yes* on the *energy* bill.

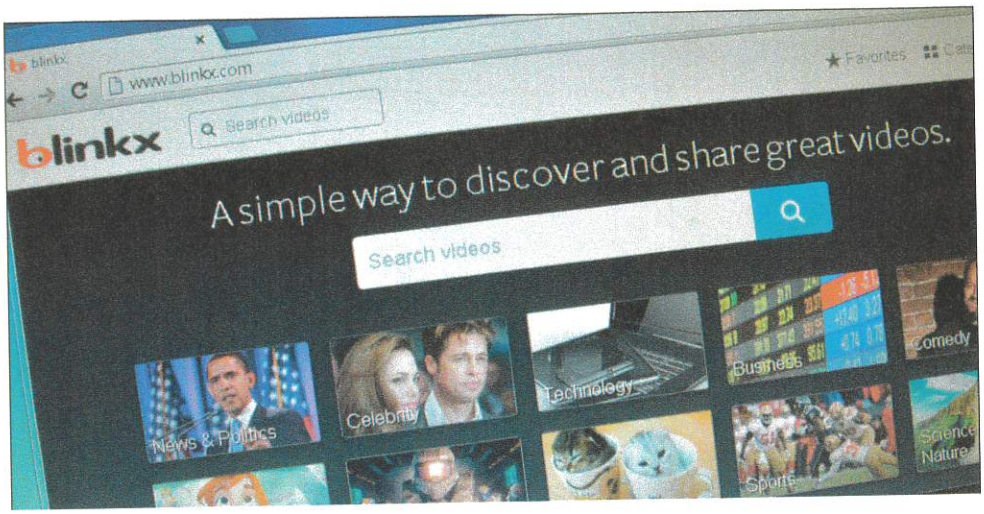


FIGURE 3.24 Blinkx is a video search engine that helps you sift through the increasing number of videos on the web. *(blinkx, LLC)*

BITS&BYTES

Searching to Do Good

Wouldn't it be great to benefit others just by searching the web? Now there's an easy way to "do good" with every search. Goodsearch (**goodsearch.com**) is a Yahoo!-powered search engine that donates half of its revenues (approximately a penny per search) to approved U.S. charities and schools that users designate. The money Goodsearch donates comes from the site's advertisers. More than 100,000 charitable organizations are being helped by Goodsearch, but if the organization you're interested in isn't on the list, as long as it's a registered U.S. not-for-profit organization, you can apply to have it added. Goodsearch has expanded its program to online shopping and dining out.

You can also contribute to your favorite charity by shopping online through Goodshop (**goodshop.com**). Instead of going directly to your favorite online store, go to Goodshop first, find and click through to the store of your choice, and start shopping. Participating stores donate up to 30% of the purchased amount. Similarly, through the GoodDining program, dine at a participating restaurant and a percentage of your bill will go to your cause. So, search, shop, and eat—and do some good!

How else can I customize my searches? Many other specialty search strategies and services are available. By clicking on Search tools in Google's menu at the top of a Google search, you can restrict search results by time, location, and even reading level (see Figure 3.25). You can also click on the Apps button in Google's main page, then click the "More" and "Even more from Google" options for all the specialized search products Google offers (see Figure 3.26):

- *Scholar* searches scholarly literature such as peer-reviewed papers, theses, and publications from academic organizations. Each search result contains bibliographic information as well.
- *Custom Search* lets you create a customized search engine to search only a selected set of sites tailored to your needs. You can add this specialized search engine to a website or blog or design it for a specific organization.
- *Google Shopping* lets you search by product rather than by company. So if you're interested in buying a digital camera, Google Shopping lists cameras by popularity and provides information on the stores that carry the cameras, along with the average price.
- *Alerts* let you know by e-mail when content that you specify has been updated, so you can monitor a developing news story or be aware of breaking news about your favorite sports team, for example.

Evaluating Websites

How can I make sure a website is appropriate to use for research? When you're using the Internet for research, you shouldn't assume that everything you find is

FIGURE 3.25 Use Google's search tools to restrict the time frame, the location, and even the reading level of your search results. *(Google, Inc.)*

accurate and appropriate to use. The following is a list of questions to consider before you use an Internet resource; the answers to these questions will help you decide whether you should consider a website to be a good source of information:

- **Authority:** Who is the author of the article or the sponsor of the site? If the author is well known or the site is published by a reputable news source (such as the *New York Times*), then you can feel more confident using it as a source than if you are unable to locate such information. *Note:* Some sites include a page with information about the author or the site's sponsor.
- **Bias:** Is the site biased? The purpose of many websites is to sell products or services or to persuade rather than inform. These sites, though useful in some situations, present a biased point of view. Look for sites that offer several sets of facts or consider opinions from several sources.
- **Relevance:** Is the information on the site current? Material can last a long time on the web. Some research projects (such as historical accounts) depend on older records. However, if you're writing about cutting-edge technologies, you need to look for the most recent sources. Therefore, look for a date on information to make sure it is current.
- **Audience:** For what audience is the site intended? Ensure that the content, tone, and style of the site match your needs. You probably wouldn't want to use information from a site geared toward teens if you're writing for adults, nor would you use a site that has a casual style and tone for serious research.
- **Links:** Are the links available and appropriate? Check out the links provided on the site to determine whether they're still working and appropriate for your needs. Don't assume that the links provided are the only additional sources of information. Investigate other sites on your topic, as well. You should also be able to find the same information on at least three different websites to help verify the information is accurate. ■

ACTIVE HELPDESK
Evaluating Websites

In this Active Helpdesk, you'll play the role of a helpdesk staffer, fielding questions about how websites can be evaluated as appropriate to use for research.

SOUND BYTE
Finding Information on the Web

In this Sound Byte, you'll learn how and when to use search engines and subject directories. Through guided tours, you'll learn effective search techniques, including how to use Boolean operators and metasearch engines.

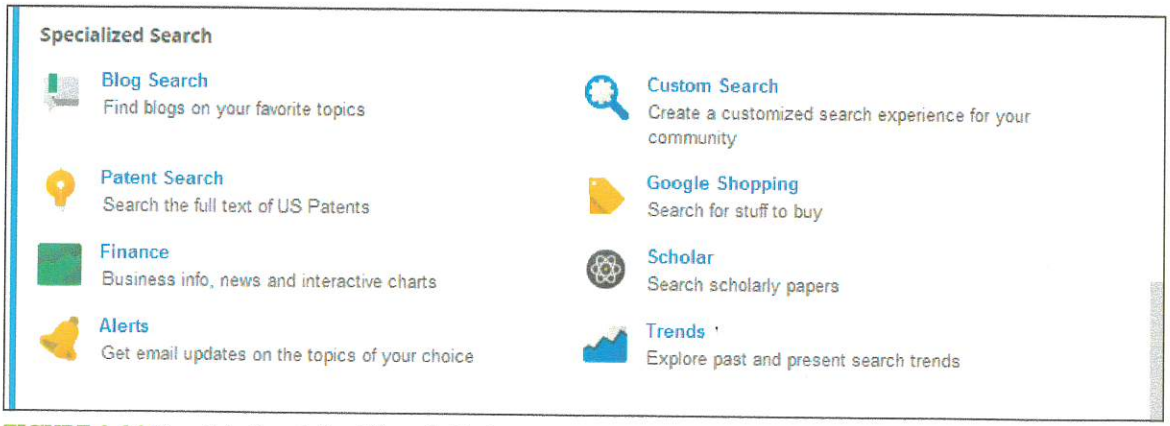


FIGURE 3.26 Google's Specialized Search Tools. *(Google, Inc.)*

ethics in IT

Plagiarism and Copyright Violation: What Can You Borrow from the Internet?

Despite having so much information easily available on the web, using it without receiving proper permissions is not only wrong but can also be illegal. So what can you borrow from the web and what must you seek permission to use? Consider these scenarios:

1. You find a political cartoon that would be terrific in a PowerPoint presentation you're creating for your civics class. You copy it into your presentation.
2. Your hobby is writing children's books, which you later sell online. Most of what you create is your content, but sometimes you borrow story ideas from other children's books and just change a few characters or situations. You do not obtain permission from the originators of the story ideas you borrow.
3. You're pressed for time and need to do research for a paper due tomorrow. You find information on an obscure website and copy it into your paper without documenting the source.
4. You download a song from the Internet and incorporate it into a PowerPoint presentation for a school project. Because you assume everyone knows the song, you don't credit it in your sources.

Which of the preceding scenarios represent copyright violations? Which represent plagiarism? The distinctions between these scenarios are narrow in some cases, but it's important to understand the differences.

Plagiarism occurs when you use someone else's ideas or words and represent them as your own. In today's computer society, it's easy to copy information from the Internet and paste it into a Word document, change a few words, and call it your own. To avoid plagiarism, properly credit all information you obtain from the Internet by using quotation marks around all words you borrow directly, and credit your sources for any ideas you paraphrase or borrow.

WriteCheck (**writecheck.com**) is a website specifically for students to help check for plagiarism violations (see Figure 3.27). The site compares your document to a database of publications, books, and web content and identifies possible plagiarism violations. Although some common phrasing may be truly coincidental, real and purposeful plagiarism is reasonably easy to identify. Students can use WriteCheck before submitting an assignment to ensure their papers are free from plagiarism and avoid the serious consequences of this offense.

Copyright violation is more serious because it, unlike plagiarism, is punishable by law. Copyright law assumes that all original work is copyrighted even if the work does not display the copyright symbol (©). Copyright violation occurs when you use another person's material for your own personal economic benefit or when you take away from the economic benefit of the originator. In most cases, citing the source is not sufficient; you need to seek and receive written permission from the copyright holder.

There are exceptions to this rule. There is no copyright on government documents, so you can download and reproduce material from any government website. The British Broadcasting Corporation (BBC) is also beginning to digitize and

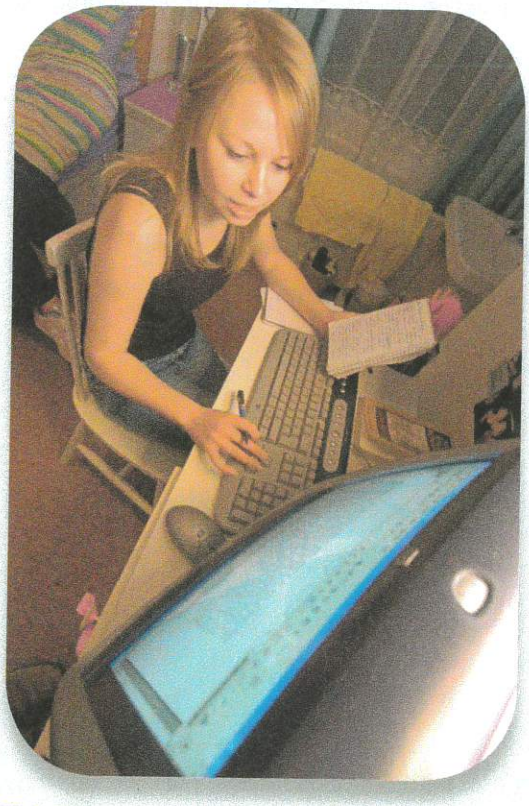


FIGURE 3.27 Students can compare their work to a database of publications in sites such as WriteCheck to check for unintended plagiarism. *(Keith Morris/Alamy)*

make available its archives of material to the public without copyright restrictions. Teachers and students receive special consideration that falls under a provision called *academic fair use*. As long as the material is being used for educational purposes only, limited copying and distribution is allowed.

One standard applied to academic fair use is the effect the use has on the potential market. For example, a student can include a cartoon in a PowerPoint presentation without seeking permission from the artist. However, to avoid plagiarism, you still must credit your sources of information.

So, do you now know which of the four scenarios above are plagiarism or copyright violations? Let's review them.

1. You are not in violation because the use of the cartoon is for educational purposes and falls under the academic fair use provision. You must still credit the source, however.
2. You are in violation of copyright laws because you are presenting others' ideas for children's stories as your own and receiving personal economic benefit from them.
3. You are guilty of plagiarism because you copied content from another source and implied it was your own work.
4. Again, because your copying is for a school project, you are not in violation of copyright laws because of the academic fair use provision. However, it's always important to document your sources.

Before moving on to the Chapter Review:

- **Watch Replay Video 3.2** .
- Then check your understanding of what you've learned so far.

check your understanding// review & practice

For a quick review to see what you've learned so far, answer the following questions. Visit **pearsonhighered.com/techinaction** to check your answers.

multiple choice

1. What is the navigation aid that shows users the path they have taken to get to a web page located within a website?
   - **a.** favorites
   - **b.** breadcrumb trail
   - **c.** bookmarks
   - **d.** social bookmarks
2. Which is NOT a component of a search engine?
   - **a.** social bookmarking site
   - **b.** indexer program
   - **c.** subject directory
   - **d.** live bookmark site
3. When using the Internet for research, you
   - **a.** can assume that everything you find is accurate and appropriate.
   - **b.** should evaluate sites for bias and relevance.
   - **c.** can assume the author is an authority on the subject matter.
   - **d.** can assume that the links provided on the site are the only additional sources of information.
4. Which of the following is not an Internet protocol?
   - **a.** ARPANET
   - **b.** HTTP
   - **c.** FTP
   - **d.** BitTorrent
5. Country codes are what part of a URL?
   - **a.** sub-top-level domain
   - **b.** top-level domain
   - **c.** path
   - **d.** protocol

To take an autograded version of this review, please go to the companion website at **pearsonhighered.com/techinaction**, or go your MyITLab course.

Continue

3 Chapter Review

summary //

The Internet and How It Works

1. What is the origin of the Internet?

- The Internet is the largest computer network in the world, connecting millions of computers.
- Government and military officials developed the early Internet as a reliable way to communicate in the event of war. Eventually, scientists and educators used the Internet to exchange research.
- Today, we use the Internet and the web (which is a part of the Internet) to shop, research, communicate, and entertain ourselves.

2. How does data travel on the Internet?

- A computer (or other device) connected to the Internet acts as either a client (a computer that asks for information) or a server (a computer that receives the request and returns the information to the client).
- Data travels between clients and servers along a system of communication lines or pathways. The largest and fastest of these pathways form the Internet backbone.
- To ensure that data is sent to the correct computer along the pathways, IP addresses (unique ID numbers) are assigned to all computers connected to the Internet.

Communicating and Collaborating on the Web

3. How can I communicate and collaborate using Web 2.0 technologies?

- Web 2.0 can be described as the social web, in which the user is also a participant.
- Examples of Web 2.0 technologies include social networking, blogs, wikis, podcasts, and webcasts.
- Social networking enables you to communicate and share information with friends as well as meet and connect with others.
- Blogs are journal entries posted to the web that are generally organized by a topic or area of interest and are publicly available.
- Video logs are personal journals that use video as the primary content in addition to text, images, and audio.
- Wikis are a type of website that allows users to collaborate on content—adding, removing, or editing it.
- Podcasts are audio or video content that is available over the Internet. Users subscribe to receive updates to podcasts.
- Webcasts are broadcasts of audio or video content over the Internet.

4. How can I communicate using e-mail and instant messaging?

- E-mail allows users to communicate electronically without the parties involved being available at the same time, whereas instant-messaging services are programs that enable you to communicate in real time with others who are online.

Web Entertainment

5. What multimedia files are found on the web, and what software is needed to access those files?

- Multimedia is anything that involves one or more forms of media in addition to text, such as graphics, audio, and video clips.
- Sometimes you need a special software program called a *plug-in* (or *player*) to view and hear multimedia files.

Conducting Business over the Internet: E-Commerce

6. What is e-commerce, and what online safeguards are available?

- E-commerce is the business of conducting business online.
- E-commerce includes transactions between businesses (B2B), between consumers (C2C), and between businesses and consumers (B2C).
- Because more business than ever before is conducted online, numerous safeguards have been put in place to ensure that transactions are protected.

Accessing and Moving Around the Web

7. What is a web browser, and what are a URL and its parts?

- Once you're connected to the Internet, in order to locate, navigate to, and view web pages, you need to install special software called a web browser on your system.
- The most common web browsers are Internet Explorer, Firefox, Google Chrome, and Safari.
- You gain access to a website by typing in its address, called a Uniform Resource Locator (URL).
- A URL is comprised of several parts, including the protocol, the domain, the top-level domain, and paths (or subdirectories).

8. How can I use hyperlinks and other tools to get around the web?

- One unique aspect of the web is that you can jump from place to place by clicking on specially formatted pieces of text or images called *hyperlinks*.
- You can also use the Back and Forward buttons, History lists, breadcrumb trails, and Favorites or Bookmarks to navigate the web.
- Favorites, live bookmarks, and social bookmarking help you return to specific web pages without having to type in the URL and help you organize the web content that is most important to you.

Searching the Web Effectively

9. How do I search the Internet effectively, and how can I evaluate websites?

- A search engine is a set of programs that searches the web using specific keywords you wish to query and then returns a list of the websites on which those keywords are found.
- Search engines can be used to search for images, podcasts, and videos in addition to traditional text-based web content.
- A subject directory is a structured outline of websites organized by topic and subtopic. Metasearch engines search other search engines.
- To evaluate whether it is appropriate to use a website as a resource, determine whether the author of the site is reputable and whether the site is intended for your particular needs. In addition, make sure that the site content is not biased, the information on the site is current, and all the links on the site are available and appropriate.

Be sure to check out the companion website for additional materials to help you review and learn, including a Tech Bytes Weekly newsletter—**pearsonhighered.com/techinaction**. And don't forget the Replay Videos.

key terms//

aggregator **83**
blog (weblog) **83**
Bookmarks **98**
Boolean operators **101**
breadcrumb trail **97**
business-to-business (B2B) **87**
business-to-consumer (B2C) **87**
client **78**
client/server network **78**
consumer-to-consumer (C2C) **87**
domain name **95**
e-commerce (electronic commerce) **87**
e-mail (electronic mail) **79**
e-mail client **80**
Favorites **98**
File Transfer Protocol (FTP) **96**
host **96**
hyperlink **97**
Hypertext Transfer Protocol (HTTP) **96**
instant messaging (IM) **81**
Internet **76**
Internet backbone **78**
Internet Protocol (IP) address **78**
keyword **98**
live bookmark **98**
metasearch engine **100**
multimedia **85**
path (subdirectory) **96**
plug-in (player) **85**
podcast **83**
Really Simple Syndication (RSS) **83**
search engine **100**
secure socket layer **88**
semantic web (Web 3.0) **90**
server **78**
social commerce **87**
social networking **79**
streaming media **85**
subject directory **100**
tagging (social bookmarking) **98**
top-level domain **96**
Uniform Resource Locator (URL) **95**
video log (vlog or video blog) **83**
Web 2.0 **79**
web-based e-mail **80**
web browser (browser) **77**
webcast **84**
web server **96**
website **95**
wiki **81**
World Wide Web (WWW or the web) **77**

chapter quiz// assessment

For a quick review to see what you've learned, answer the following questions. Submit the quiz as requested by your instructor. If you are using MyITLab, the quiz is also available there.

multiple choice

1. The Internet was created to provide:
   a. a secure form of communications.
   b. a common communications means for all computers.
   c. both A and B.
   d. neither A or B.
2. Which of the following describes an IP address?
   a. It is referred to as a dotted quad.
   b. It identifies any computer connecting to the Internet.
   c. It identifies a website.
   d. All of the above.
3. Which of the following is an installed e-mail client?
   a. Outlook
   b. Windows Messenger
   c. Gmail
   d. Yahoo! mail
4. What web browser feature would be particularly useful when using public computers?
   a. Pinned tabs
   b. Session restore
   c. Privacy browsing
   d. All of the above
5. In the URL http://www.whitehouse.gov/blog, which part is considered the path or subdirectory?
   a. http
   b. .gov
   c. www.whitehouse.gov
   d. /blog
6. Search engines that search other search engines are called
   a. metasearch engines.
   b. betasearch engines.
   c. gigasearch engines.
   d. megasearch engines.

true–false

_____ 1. A search engine that searches other search engines is called a SuperSearch engine.

_____ 2. Webcasts are only delivered as prerecorded audio and video content.

_____ 3. The "s" in HTTPS stands for secure and indicates that the secure sockets layer protocol has been applied to the website.

_____ 4. IP addresses are used to identify computers connected to the Internet.

critical thinking

1. **The Power of Google**

   Google is the largest and most popular search engine on the Internet today. Because of its size and popularity, some people claim that Google has enormous power to influence a web user's search experience solely by its website-ranking processes. What do you think about this potential power? How could it be used in negative or harmful ways?

   a. Some websites pay search engines to list them near the top of the results pages. These sponsors therefore get priority placement. What do you think of this policy?

   b. What effect (if any) do you think that Google has on website development? For example, do you think website developers intentionally include frequently searched words in their pages so that they will appear in more hit lists?

2. **Mobile E-Commerce Safety**

   The text lists several ways to ensure your online transactions are secure and to reduce the risk of things going awry as you shop and sell online. However, surveys indicate that many feel that shopping from a mobile device, such as a smartphone, presents additional risks. Do you agree there are additional risks when conducting e-commerce from a mobile device? Why or why not?

team time//

Collaborating with Technology

Problem

Collaborating on projects with team members is a regular part of business and academia. Many great tools are available that facilitate online collaboration, and it's important to be familiar with them. In this Team Time, each team will create a group report on a specific topic, using online collaboration tools, and compare and rate the tools and the collaboration process.

Process

Split your group into teams. To appreciate fully the benefits of online collaboration, each team should have at least five or six members. Each group will create a team report on a topic that is approved by your instructor. As part of the report, one group member should record the process the group took to create the report, including a review of the tools used and reflections on the difficulties encountered by the group.

1. Conduct a virtual meeting. Agree on an online meeting and video collaboration tool such as Skype, Google+ Hangouts, ooVoo, or Tinychat and conduct a group chat. In this phase, outline your group project strategy and delegate work responsibilities.
2. Share documents and collaborate online. Your group must create one document that is accessible to every member at all times. Explore document-sharing sites such as Google Drive, Evernote, OneDrive, or Dropbox and collaboratively create your group document. All members are responsible for reviewing the entire document.

Conclusion

After all the team group reports have been completed and shared, discuss the following with your class: What is the benefit of using online collaboration technology to create group projects? How did collaboration technologies help or hinder the team process?

ethics project//

Plagiarism

In this exercise, you'll research and then role-play a complicated ethical situation. The role you play may or may not match your own personal beliefs, but your research and use of logic will enable you to represent whichever view is assigned. An arbitrator will watch and comment on both sides of the arguments, and together the team will agree on an ethical solution.

Problem

Plagiarism, or portraying another's work as your own, has been around for a long time and extends well beyond the classroom. For example, Nick Simmons, the son of Gene Simmons (from KISS) and a member of A&E's *Family Jewels* reality series, created a comic book series, *Incarnate*. Radical Publishing picked up the series but quickly stopped publication when Internet messages accused the author of copying from other similar series. Similarly, the Australian band Men at Work was cited for copying a melody from "Kookaburra Sits in the Old Gum Tree" for its 1980s hit "Down Under" and owes the owner years of royalties.

Research Areas to Consider

- Plagiarism violations
- Comic book series *Incarnate*
- Australian band Men at Work
- Plagiarism consequences

Process

1. Divide the class into teams. Research the areas cited above and devise a scenario in which someone has violated plagiarism rules.
2. Team members should write a summary that provides background information for their character—for example, author, publisher, or arbitrator—and that details their character's behaviors to set the stage for the role-playing event. Then team members should create an outline to use during the role-playing event.
3. Team members should arrange a mutually convenient time to meet for the exchange, using a virtual meeting tool or by meeting in person.
4. Team members should present their case to the class or submit a PowerPoint presentation for review by the rest of the class, along with the summary and resolution they developed.

Conclusion

As technology becomes ever more prevalent and integrated into our lives, more and more ethical dilemmas will present themselves. Being able to understand and evaluate both sides of an argument, while responding in a personally or socially ethical manner, will be an important skill.

Solve This

MyITLab® grader

Create a Report: Conducting Research on the Web

You and a partner have been asked to write a report on alternatives to using the Google search engine, as well as how to evaluate a website for a research paper. The paper needs to cite references within the body of the text, and include a list of your works cited at the end of the report. Your partner has begun the report. You are going to modify what has been started.

You will use the following skills as you complete this activity:	
• Use Find and Replace	• Insert a Hyperlink
• Format Bulleted Lists	• Add Sources
• Insert SmartArt	• Insert Citations and Bibliography

Instructions:

1. Start Word. Open *TIACh3_Start.docx* and save it as **TIACh3_LastFirst.docx**, using your last and first name.
2. Using Find and Replace, find all instances of *metasearch* and replace them with **meta-search**.
3. At the blank paragraph after the end of the second paragraph of text under *Alternative Search Engines*, insert a Vertical Box List SmartArt graphic. Open the text pane, if necessary. Place the cursor after the first bullet, and enter **Google Scholar**. (Do not include the period.) Press Enter, press Tab and then type **Searches scholarly literature**. (Do not include the period.)

   Repeat these steps to add the following information for the next two bullets:
   Dogpile
   Meta-search engine that searches Google, Yahoo!, and Bing
   Yippy
   Meta-search engine that groups similar results into topics
   Press Enter, press Shift +Tab, and then type **InfoMine**
   Press Enter, then press Tab and type **Subject directory of academic resources using keywords**

   Hint: To insert a SmartArt graphic, on the INSERT tab, in the Illustrations group, click SmartArt.
4. Change the SmartArt graphic colors to Colorful—Accent. Move the Google Scholar box and bullet point to the bottom of the SmartArt. Change the SmartArt Style to Intense Effect.

   Hint: To change the colors, on the SMARTART DESIGN tab, in the SmartArt Styles group, click Colors. To move the box and bullet point, in the Create Graphic group, click Move Down. To change the style, in the SmartArt Styles group, click the more button for Styles.
5. In the second to last sentence of the first paragraph in the Alternative Search Engines section, select the text *list of subject directories*. Then, create a hyperlink to the web page **http://hanlib.sou.edu/searchtools.subjdir.html**. (Do not include the period.)
6. At the end of the first paragraph in the *Evaluating Websites* section, immediately to the left of the period, insert a citation to a new Web Site source using the following information:

   Author: **Kapoun, Jim**
   Name of Web Page: **Five criteria for evaluating Web pages**
   Name of Web Site: **Olin & Uris Libraries, Cornell University**
   Year: **2010**
   Month: **May**
   Day: **10**
   URL: **http://olinuris.library.cornell.edu/ref/research/webcrit.html**

   Hint: To display the URL field, click the checkbox for Show All Bibliography Fields.
7. In the Evaluating Websites section, create a bulleted list with the five points beginning with *Authority, Bias or Objectivity, Relevance, Audience,* and *Coverage*. Use a checkmark as the bullet point.
8. Press CTRL + End to go to the end of the document, press Enter, and then insert a Works Cited Bibliography. Change the citation style to **APA Sixth Edition**.

   Hint: To create a Works Cited Bibliography, on the REFERENCES tab, in the Citations & Bibliography group, click Bibliography. To change the citation style, click the more button for Style.
9. Save the document, and then close Word.
10. Submit the document as directed.

Technology in Focus

The History of the Personal Computer

Ever wonder how big the first personal computer was or how much the first laptop weighed? Computers are such an integral part of our lives that we don't often stop to think about how far they've come or where they got their start. In just 40 years, computers have evolved from expensive, huge machines that only corporations could own to small, powerful devices that almost anyone can have. In this Technology in Focus feature, we look at the history of the personal computer.

FIGURE 1 Timeline of Early Personal Computer Development

The Altair 8800

- Only 256 bytes of memory
- No keyboard or monitor
- Switches on front used to enter data in machine code (1s and 0s)
- Lights on front indicated results of a program

1975

Commodore PET

- Featured in *Popular Science* magazine
- Popular in business settings in Europe

October 1977

1976

Apple I

Steve Jobs and Steve Wozniak form Apple Computer

June 1977

Apple II

- Featured color monitor, sound, and game paddles
- 4 KB of RAM
- Operating system stored in ROM
- Optional floppy disk to load programs (mostly games)

(AP Photo/Heinz Nixdorf Museumsforum; SSPL/The Image Works; Marilyn K. Yee/New York Times Co./Getty Images; AP Photo/Steve Castillo; SSPL/Getty Images; Jerry Mason/Photo Researchers, Inc.)

The First Personal Computer: The Altair

Our journey through the history of the personal computer starts in 1975. At that time, most people weren't familiar with the mainframes and supercomputers that large corporations and the government owned. With price tags exceeding the cost of buildings, and with few if any practical home uses, these monster machines weren't appealing to or attainable by average Americans.

However, in 1975, the first personal computer, the **Altair 8800** (see Figure 1), was born. At $395 for a do-it-yourself kit or $498 for a fully assembled unit (about $2,236 in today's dollars), the price was reasonable enough that computer fanatics could finally own their own computers.

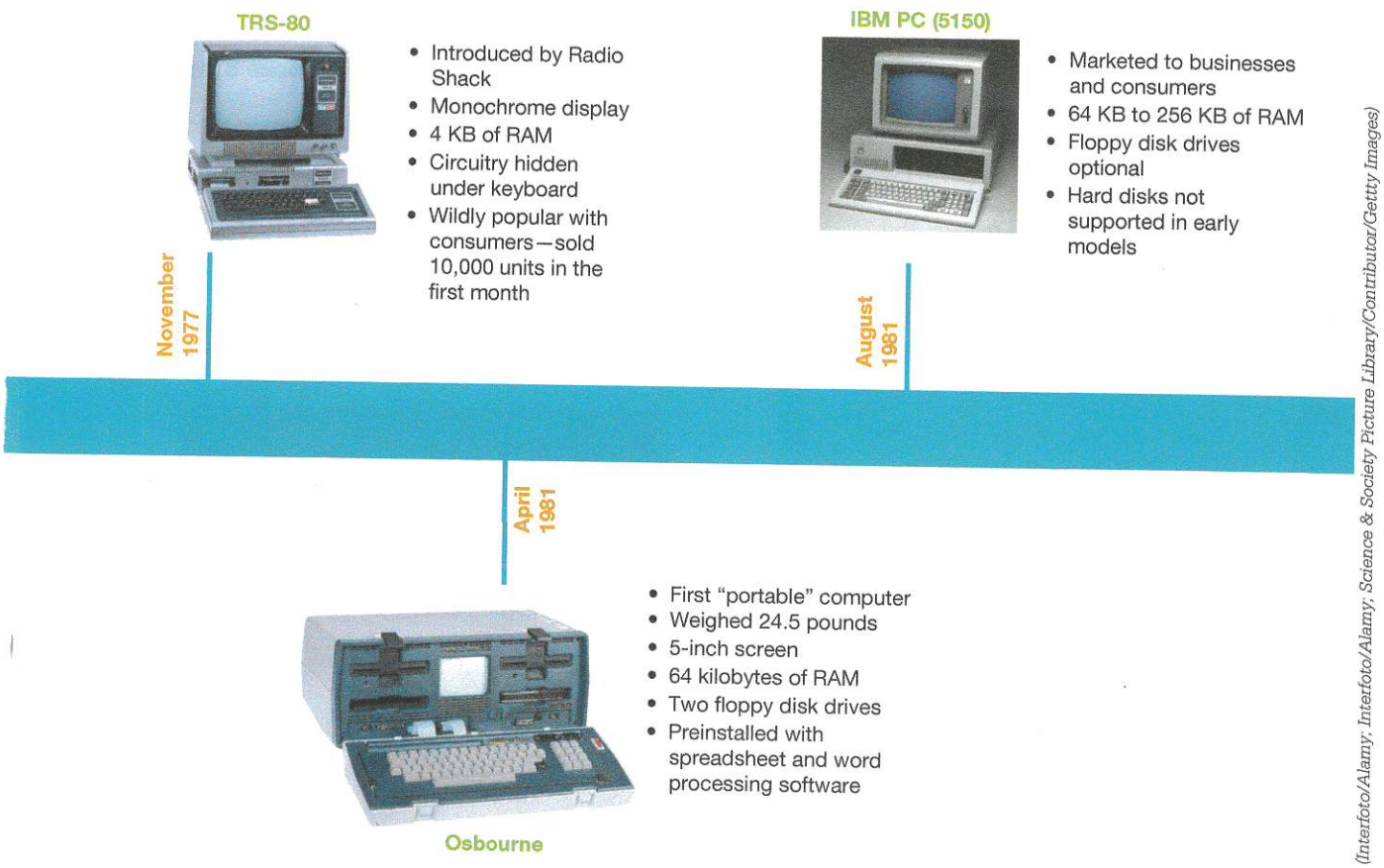
The Altair was primitive by today's standards—no keyboard, no monitor, and completely not user friendly. Despite its limitations, computer enthusiasts flocked to the machine. Many who bought it had been taught to program, but until that point, they had access only to big, clumsy computers at their jobs. With the Altair, they could create their own programs. Within three months, 4,000 orders were placed for the machine.

The release of the Altair marked the start of the personal computer boom. In fact, two men whose names you might have heard were among the first Altair owners: Bill Gates and Paul Allen were so enamored by the "minicomputer" that they wrote a compiling program (a program that translates user commands into commands the computer can understand) for it. The two later convinced the Altair's developer to buy their program, marking the start of a company called Microsoft. We'll get to that story later. First, let's see what their rivals were up to.

The Apple I and II

Around the time the Altair was released, **Steve Wozniak**, an employee at Hewlett-Packard, was dabbling with his own computer design. **Steve Jobs**, who was working for computer game manufacturer Atari at the time, liked Wozniak's prototypes and made a few suggestions. Together, the two built a personal computer, the **Apple I**, in Wozniak's garage (see Figure 1) and formed the Apple Computer Company in 1976.

A year later, in 1977, the **Apple II** was born (see Figure 1). The Apple II included a color monitor, sound, and game



(Interfoto/Alamy; Interfoto/Alamy; Science & Society Picture Library/Contributor/Getty Images)

Why Is It Called "Apple"?

(Prisma Bildagentur AG/Alamy)

Steve Jobs wanted Apple Computer to be the "perfect" computer company. Having recently worked at an apple orchard, Jobs thought of the apple as the perfect fruit because it was high in nutrients, came in a nice package, and was not easily damaged. Thus, he and Wozniak decided to name their computer company Apple.

paddles. Priced around $1,300 (about $5,206 in today's dollars), one of its biggest innovations was that the operating system was stored in read-only memory (ROM). Previously, the operating system had to be rewritten every time the computer was turned on. The friendly features of the Apple II operating system encouraged less technically oriented computer enthusiasts to write their own programs.

An instant success, the Apple II would eventually include a spreadsheet program, a word processor, and desktop publishing software. These programs gave personal computers like the Apple functions beyond gaming and special programming and led to their popularity.

Enter the Competition

Around the time Apple was experiencing success with its computers, a number of competitors entered the market. The largest among them were Commodore, Radio Shack, Osborne, and IBM. The **Commodore PET** (see Figure 1) was aimed at the business market and did well in Europe, while Radio Shack's **TRS-80** (see Figure 1) was clearly aimed at the U.S. consumer market. Just one month after its release in 1977, it had sold about 10,000 units.

The Osborne: The Birth of Portable Computing

The Osborne Company introduced the first portable computer, the **Osborne**, in 1981 (see Figure 1). Although portable, the computer weighed 24.5 pounds. It featured a minuscule 5-inch screen and carried a price tag of $1,795 (about $4,704 today). The Osborne was an overnight success, and its sales quickly reached 10,000 units per month. However, despite the computer's popularity, the Osborne Company eventually closed. Compaq bought the Osborne design and in 1983 produced its own portable computer.

IBM PCs

Until 1980, IBM primarily made mainframe computers, which it sold to large corporations, and hadn't taken the personal computer seriously. In 1981, however, IBM released its first personal computer, the **IBM PC** (see Figure 1). Because many companies were familiar with IBM mainframes, they adopted the IBM PC. The term *PC* soon became the term used to describe all personal computers.

IBM marketed its PC through retail outlets such as Sears to reach home users, and it quickly dominated that market. In January 1983, *Time* magazine, playing on its annual person of the year issue, named the computer "1982 Machine of the Year."

Other Important Advancements

It wasn't just personal computer hardware that was changing. At the same time, advances in programming languages and operating systems and the influx of application software were leading to more useful and powerful machines.

The Importance of BASIC

The software industry began in the 1950s with programming languages such as FORTRAN, ALGOL, and COBOL. These languages were used mainly by businesses to create financial, statistical, and engineering programs. However, the 1964 introduction of **Beginners All-Purpose Symbolic Instruction Code (BASIC)** revolutionized the software industry. BASIC was a language that beginning programming students could easily learn. It thus became enormously popular—and the key language of the PC. In fact, **Bill Gates** and **Paul Allen** (see Figure 2) used BASIC to write their program for the Altair. As we noted earlier, this program led to the creation of **Microsoft**, a company that produced computer software.

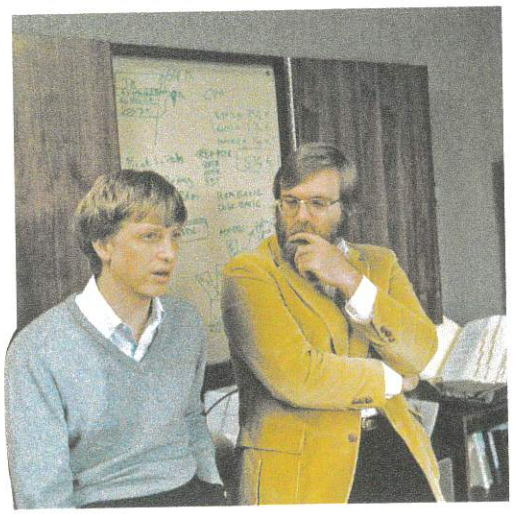


FIGURE 2 Bill Gates and Paul Allen are the founders of Microsoft. *(Doug Wilson/CORBIS)*

The Advent of Operating Systems

Because data on the earliest personal computers was stored on audiocassettes, many programs weren't saved or reused. This meant that programs had to be rewritten whenever they were needed. In 1978, Steve Wozniak designed a 5.25-inch floppy disk drive so that programs could be saved easily and operating systems developed.

Operating systems are written to coordinate with the specific processor chip that controls the computer. At that time, Apples ran on a Motorola chip, whereas PCs (IBMs and so on) ran on an Intel chip. **Disk Operating System (DOS)**, developed by Wozniak and introduced in 1977, was the OS that controlled the first Apple computers. The **Control Program for Microcomputers (CP/M)**, developed by Gary Kildall, was the OS designed for the Intel 8080 chip (the processor for PCs).

In 1980, when IBM was entering the personal computer market, it approached Bill Gates at Microsoft to write an OS program for the IBM PC. Gates recommended that IBM investigate the CP/M OS, but IBM couldn't arrange a meeting with the founder, Gary Kildall. Microsoft reconsidered the opportunity to write an OS program and developed **MS-DOS** for IBM computers. Eventually, virtually all PCs running on the Intel chip used MS-DOS as their OS. Microsoft's reign as one of the dominant players in the personal computer landscape had begun.

The Software Application Explosion: VisiCalc and Beyond

Because the floppy disk was a convenient way to distribute software, its inclusion in personal computers set off an application software explosion. In 1978, Harvard Business School student Dan Bricklin recognized the potential for a personal computer spreadsheet program. He and his friend Bob Frankston created the program **VisiCalc**, which became an instant success. Finally, ordinary home users could see the benefit of owning a personal computer. More than 100,000 copies of VisiCalc were sold in its first year.

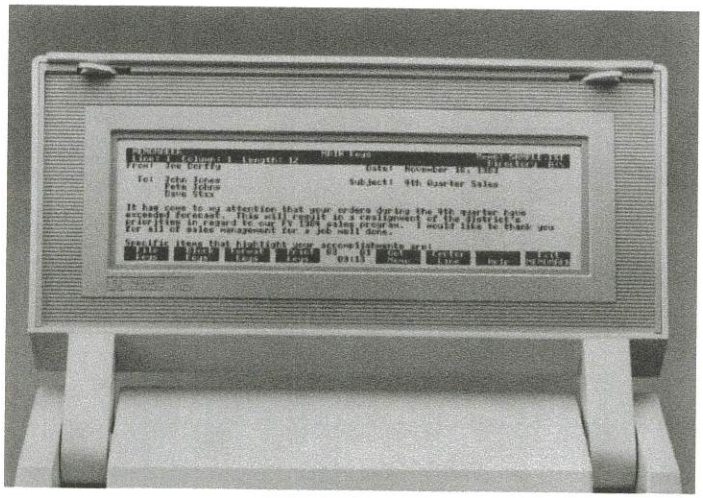


FIGURE 3 This 1983 Hewlett-Packard computer used an early version of the MS-DOS operating system as well as the Lotus 1-2-3 spreadsheet program. *(Everett Collection / SuperStock)*

FIGURE 4

Application Software Development

YEAR	APPLICATION
1978	**VisiCalc:** First electronic spreadsheet application **WordStar:** First word processing application
1980	**WordPerfect:** Best DOS-based word processor, was eventually sold to Novell and later acquired by Corel
1983	**Lotus 1-2-3:** Added integrated charting, plotting, and database capabilities to spreadsheet software **Word for MS-DOS:** Introduced in the pages of *PC World* magazine on the first magazine-inserted demo disk
1985	**Excel:** One of the first spreadsheets to use a graphical user interface **PageMaker:** The first desktop publishing software

After VisiCalc, other electronic spreadsheet programs entered the market. **Lotus 1-2-3** came on the market in 1983 (see Figure 3), and **Microsoft Excel** entered the scene in 1985. These products became so popular that they eventually put VisiCalc out of business.

Meanwhile, word processing software was also gaining a foothold in the industry. Until then, there were separate, dedicated word processing machines; personal computers, it was believed, were for computation and data management only. However, once **WordStar**, the first word processing application, became available for personal computers in 1979, word processing became another important use for the personal computer. Competitors such as **Word for MS-DOS** (the precursor to Microsoft Word) and **WordPerfect** soon entered the market. Figure 4 lists some of the important dates in application software development.

The Graphical User Interface

Another important advancement in personal computers was the introduction of the **graphical user interface (GUI)**, which allowed users to interact with the computer more easily. Until that time, users had to use complicated command- or menu-driven interfaces. Apple was the first company to take full commercial advantage of the GUI, but the GUI was not invented by a computer company.

Xerox: Birth of the GUI

In 1972, a few years before Apple launched its first personal computer, photocopier manufacturer **Xerox** was designing

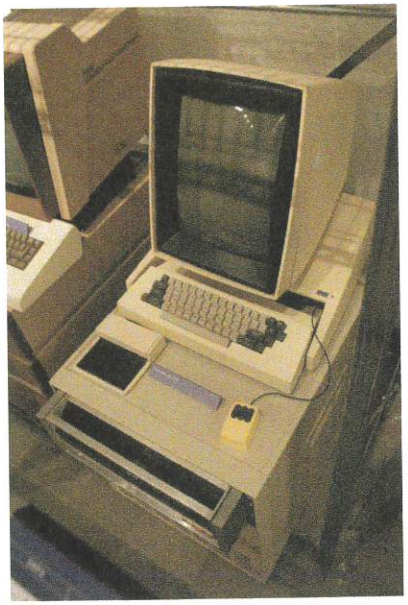


FIGURE 5 The Alto was the first computer to use a GUI, and it provided the basis for the GUI that Apple used. However, because of marketing problems, the Alto never was sold. *(Josie Lepe/MCT/Newscom)*

FIGURE 6 The Lisa was the first computer to introduce a GUI to the market. Priced too high, it never gained the popularity it deserved. *(SSPL/The Image Works)*

a personal computer of its own. Named the **Alto** (see Figure 5), the computer included a word processor, based on the What You See Is What You Get (WYSIWYG) principle, that incorporated a file management system with directories and folders. It also had a mouse and could connect to a network. None of the other personal computers of the time had these features. For a variety of reasons, Xerox never sold the Alto commercially. Several years later, it developed the Star Office System, which was based on the Alto. Despite its convenient features, the Star never became popular because no one was willing to pay the $17,000 asking price.

The Lisa and the Macintosh

Xerox's ideas were ahead of their time, but many of the ideas present in the Alto and Star would soon catch on. In 1983, Apple introduced the **Lisa**, the first successful personal computer brought to market that used a GUI (see Figure 6). Legend has it that Jobs had seen the Alto during a visit to Xerox in 1979 and was influenced by its GUI. He therefore incorporated a similar user interface into the Lisa, providing features such as windows, drop-down menus, icons, a file system with folders and files, and a point-and-click device called a mouse. The only problem with the Lisa was its price. At $9,995 (about $23,866 in today's dollars), few buyers were willing to take the plunge.

A year later, in 1984, Apple introduced the **Macintosh**, shown in Figure 7. The Macintosh was everything the Lisa was and then some, at about a third of the cost. The Macintosh was also the first personal computer to utilize 3.5-inch floppy disks with a hard cover, which were smaller and sturdier than the previous 5.25-inch floppies.

The Internet Boom

The GUI made it easier for users to work on the computer. The Internet provided another reason for people to buy computers. Now people could conduct research and communicate in a new way. In 1993, the web browser **Mosaic** was introduced. This browser allowed users to view multimedia on the web, causing Internet traffic to increase by nearly 350%.

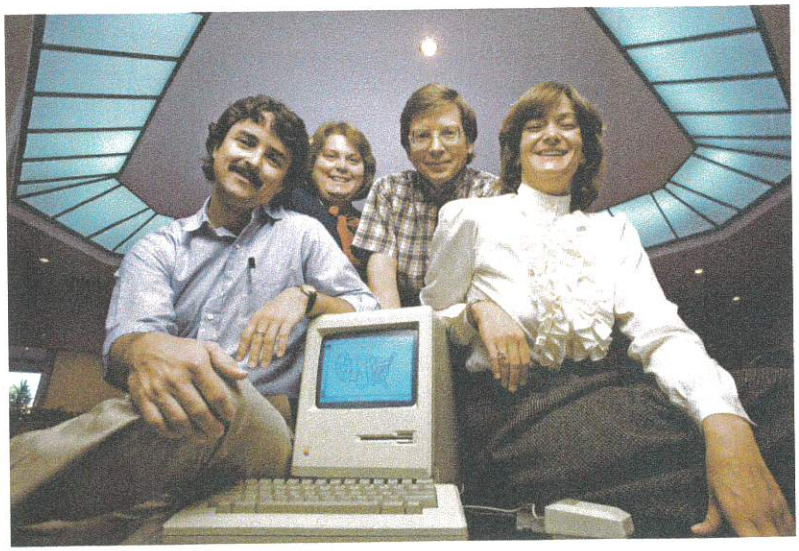


FIGURE 7 The Macintosh became one of Apple's best-selling computers, incorporating a GUI along with other innovations such as the 3.5-inch floppy disk drive. *(Ed Kashi/CORBIS)*

Meanwhile, companies discovered the Internet as a means to do business, and computer sales took off. IBM-compatible PCs became the computer system of choice when, in 1995, Microsoft introduced **Internet Explorer**, a browser that integrated web functionality into Microsoft Office applications, and **Windows 95**, the first Microsoft OS designed to be principally a GUI OS.

About a year earlier, in 1994, a team of developers launched the **Netscape** web browser, which soon became a predominant player in browser software. However, pressures from Microsoft became too strong, and in 1998, Netscape announced it would no longer charge for the product and would make the code available to the public.

Making the Personal Computer Possible: Early Computers

Billions of personal computers have been sold over the past three decades. But the computer is a compilation of parts, each of which is the result of individual inventions. Let's look at some early machines that helped to create the personal computer we know today.

The Pascalene Calculator and the Jacquard Loom

From the earliest days of humankind, we have been looking for a more systematic way to count and calculate. Thus, the evolution of counting machines led to the development of the computer we know today. The **Pascalene** was the first accurate mechanical calculator. This machine, created by the French mathematician **Blaise Pascal** in 1642, used revolutions of gears, like odometers in cars, to count by tens. The Pascalene could be used to add, subtract, multiply, and divide. The basic design of the Pascalene was so sound that it lived on in mechanical calculators for more than 300 years.

Nearly 200 years later, **Joseph Jacquard** revolutionized the fabric industry by creating a machine that automated the weaving of complex patterns. Although not a counting or calculating machine, the **Jacquard loom** (shown in Figure 8) was significant because it relied on stiff cards with punched holes to automate the weaving process. Much later, this punch-card process would be adopted as a means for computers to record and read data.

Babbage's Engines

In 1834, **Charles Babbage** designed the first automatic calculator, called the **Analytical Engine** (see Figure 9). The machine was actually based on another machine called the **Difference Engine**, which was a huge steam-powered mechanical calculator that Babbage designed to print astronomical tables. Although the Analytical Engine was never developed, Babbage's detailed drawings and descriptions of the machine include components similar to those found in today's computers, including the store (akin to RAM) and the mill (a central processing unit) as well as input and output devices. This invention gave Charles Babbage the title of the "father of computing."

FIGURE 8 The Jacquard loom used holes punched in stiff cards to make complex designs. This technique would later be used in punch cards that controlled the input and output of data in computers. *(JANEK SKARZYNSKI/AFP/Getty Images/Newscom)*

Meanwhile, Ada Lovelace, who was the daughter of poet Lord Byron and a student of mathematics (which was unusual for women of the time), was fascinated with Babbage's Engines. She translated an Italian paper on Babbage's machine and, at the request of Babbage, added her own extensive notes. Her efforts are thought to be the best description of Babbage's Engines.

The Hollerith Tabulating Machine

In 1890, **Herman Hollerith**, while working for the U.S. Census Bureau, was the first to take Jacquard's punch-card concept and apply it to computing with his **Hollerith Tabulating Machine**. Until that time, census data had been tabulated manually in a long, laborious process. Hollerith's tabulating machine automatically read data that had been punched onto small punch cards, speeding up the tabulation process. Hollerith's machine became so successful that he left the Census Bureau in 1896 to start the Tabulating

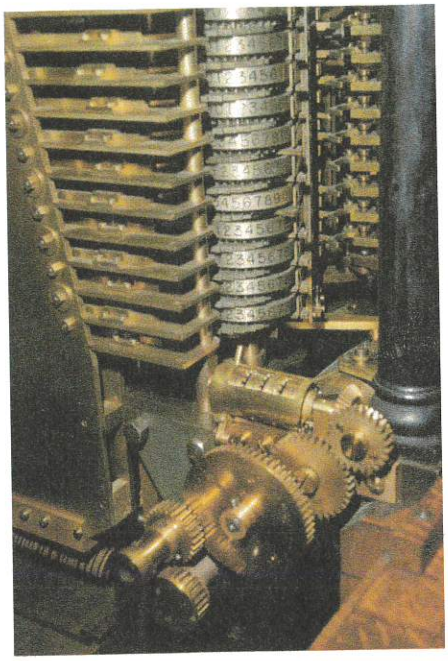


FIGURE 9 The Analytical Engine, designed by Charles Babbage, was never fully developed but included components similar to those found in today's computers. *(Chris Howes/Wild Places Photography/Alamy)*

Machine Company. His company later changed its name to International Business Machines, or IBM.

The Z1 and the Atanasoff–Berry Computer

German inventor **Konrad Zuse** is credited with a number of computing inventions. His first, in 1936, was a mechanical calculator called the **Z1**. The Z1 is thought to be the first computer to include certain features integral to today's systems, such as a control unit and separate memory functions.

In 1939, John Atanasoff, a professor at Iowa State University, and his student Clifford Berry built the first electrically powered digital computer, called the **Atanasoff–Berry Computer (ABC)**, shown in Figure 10. The computer was the first to use vacuum tubes, instead of the mechanical switches used in older computers, to store data. Although revolutionary at the time, the machine weighed 700 pounds, contained a mile of wire, and took about 15 seconds for each calculation. (In comparison, today's personal computers can perform billions of calculations in 15 seconds.) Most importantly, the ABC was the first computer to use the binary system and to have memory that repowered itself upon booting. The design of the ABC would be central to that of future computers.

The Harvard Mark I

From the late 1930s to the early 1950s, **Howard Aiken** and **Grace Hopper** designed the Mark series of computers used by the U.S. Navy for ballistic and gunnery calculations. Aiken, an electrical engineer and physicist, designed the computer, while Hopper did the programming. The **Harvard Mark I**, finished in 1944, could add, subtract, multiply, and divide.

However, many believe Hopper's greatest contribution to computing was the invention of the **compiler**, a program that translates English-language instructions into computer language. The team was also responsible for a common computer-related expression. Hopper was the first to "debug" a computer when she removed a moth that had flown into the Harvard Mark I and had caused the computer to break down (see Figure 11). After that, problems that caused a computer not to run were called *bugs*.

The Turing Machine

Meanwhile, in 1936, British mathematician **Alan Turing** created an abstract computer model that could perform logical operations. The **Turing Machine** was not a real machine but rather a hypothetical model that mathematically defined a mechanical procedure (or algorithm). Additionally, Turing's concept described a process by which the machine

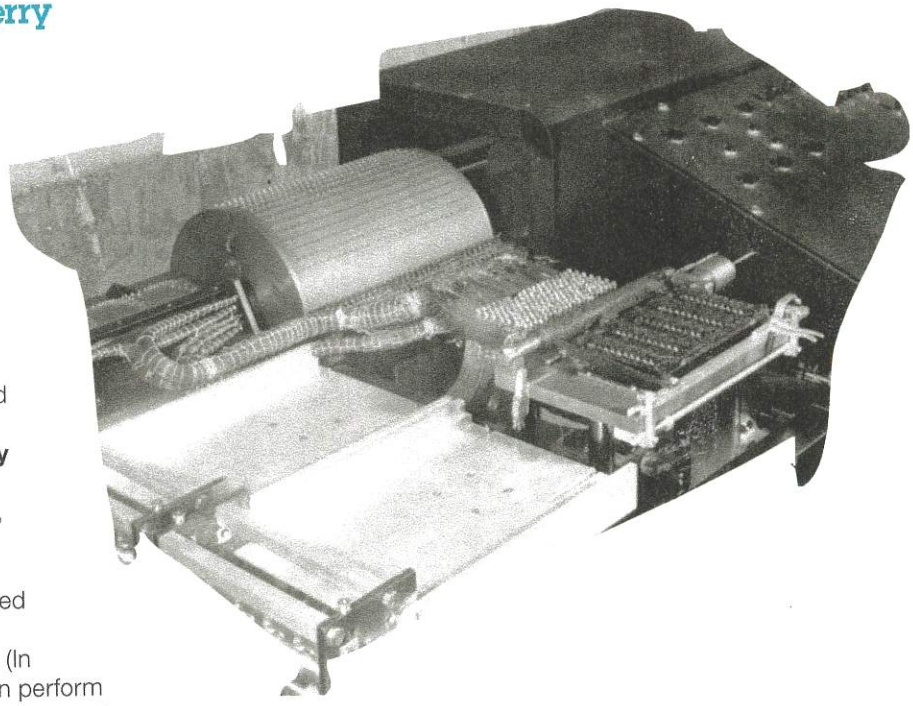


FIGURE 10 The Atanasoff–Berry Computer laid the design groundwork for many computers to come. *(AP Photo/Frederick News-Post)*

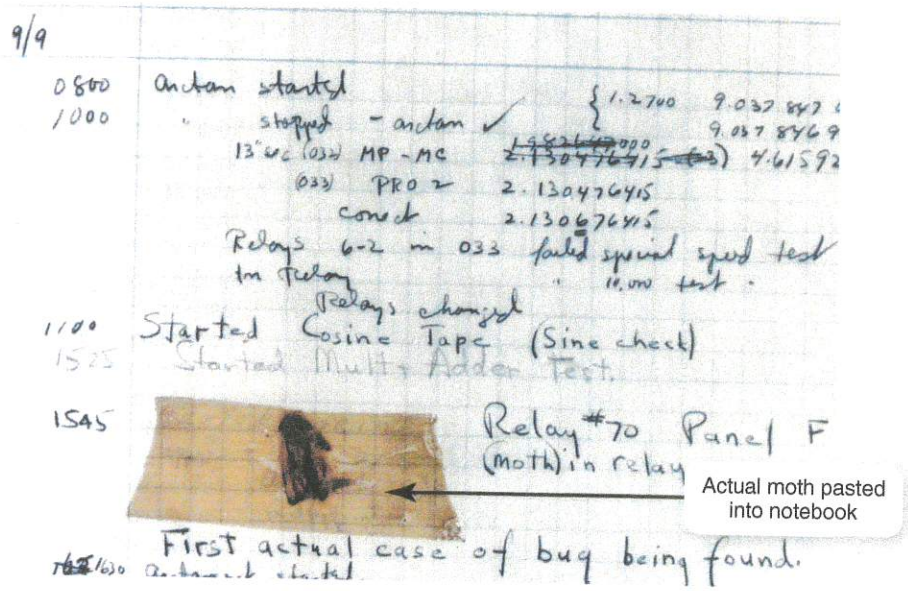


FIGURE 11 Grace Hopper coined the term *computer bug* when a moth flew into the Harvard Mark I, causing it to break down. *(Naval History and Heritage Command, photo # NH 96566)*

could read, write, or erase symbols written on squares of an infinite paper tape. This concept of an infinite tape that could be read, written to, and erased was the precursor to today's RAM.

The ENIAC

The **Electronic Numerical Integrator and Computer (ENIAC)**, shown in Figure 12, was another U.S. government–sponsored machine developed to calculate the settings used for weapons. Created by **John W. Mauchly** and **J. Presper Eckert** at the University of Pennsylvania, it was put into operation in 1944. Although the ENIAC is generally thought of as the first successful high-speed electronic digital computer, it was big and clumsy. The ENIAC used nearly 18,000 vacuum tubes and filled approximately 1,800 square feet of floor space. Although inconvenient, the ENIAC served its purpose and remained in use until 1955.

The UNIVAC

The **Universal Automatic Computer**, or **UNIVAC**, was the first commercially successful electronic digital computer. Completed in 1951, the UNIVAC operated on magnetic tape (see Figure 13), setting it apart from its competitors, which ran on punch cards. The UNIVAC gained notoriety when, in a 1951 publicity stunt, it was used to predict the outcome of the Stevenson–Eisenhower presidential race. After analyzing only 5% of the popular vote, the UNIVAC correctly identified Dwight D. Eisenhower as the victor. After that, UNIVAC soon became a household word. The UNIVAC and computers like it were considered **first-generation computers** and were the last to use vacuum tubes to store data.

Transistors and Beyond

Only a year after the ENIAC was completed, scientists at the Bell Telephone Laboratories in New Jersey invented

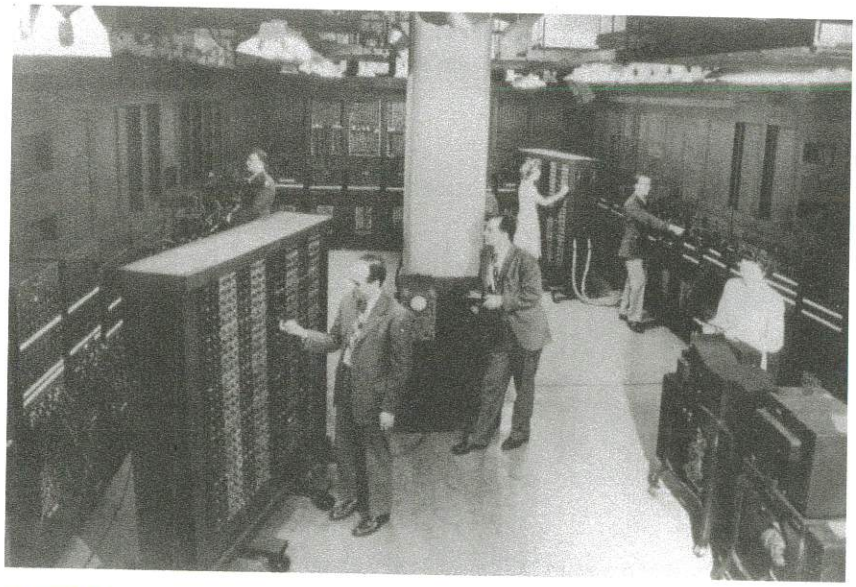


FIGURE 12 The ENIAC took up an entire room and required several people to manipulate it. *(University of Pennsylvania/AP Images)*

FIGURE 13 UNIVACs were the first computers to use magnetic tape for data storage. *(CBS/Landov)*

the **transistor**, another means to store data (see Figure 14). The transistor replaced the bulky vacuum tubes of earlier computers and was smaller and more powerful than tubes. It was used in almost everything, from radios to phones. Computers that used transistors were referred to as **second-generation computers**. Still, transistors were limited as to how small they could be made.

A few years later, in 1958, **Jack Kilby**, while working at Texas Instruments, invented the world's first **integrated circuit**, a small chip capable of containing thousands of transistors. This consolidation in design enabled computers to become smaller and lighter. The computers in this early integrated-circuit generation were considered **third-generation computers**.

Other innovations in the computer industry further refined the computer's speed, accuracy, and efficiency. However, none was as significant as the 1971 introduction by the Intel Corporation of the **microprocessor chip**, a small chip containing millions of transistors (see Figure 15). The microprocessor functions as the central processing unit (CPU), or brains, of the computer. Computers that use a microprocessor chip are called **fourth-generation computers**. Over time, Intel and Motorola became the leading manufacturers of microprocessors. Today, the Intel Core i7 is one of Intel's most powerful processors.

As you can see, personal computers have come a long way since the Altair and have a number of inventions and people to thank for their amazing popularity. What will the future bring? ■

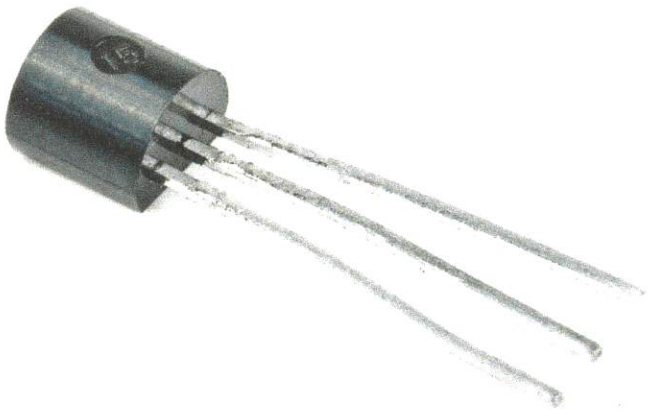


FIGURE 14 Transistors were 1/10 the size of vacuum tubes, faster, and produced much less heat. *(borissos/Fotolia)*

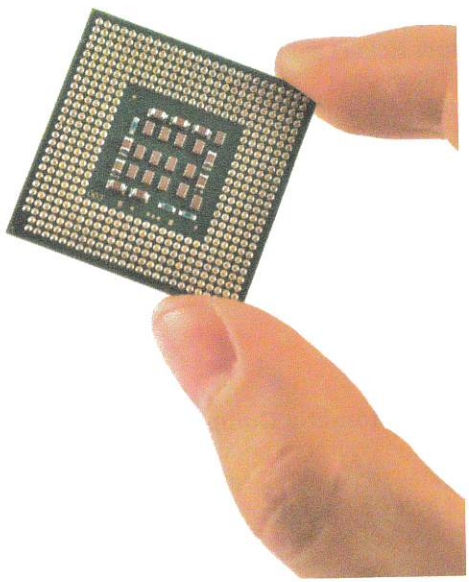


FIGURE 15 Today's microprocessors can contain billions of transistors. *(Tudor Voinea/Shutterstock)*