



# Employment, trends, and training

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**A**mari and Aaron have always loved computers. Growing up, Amari spent much of her free time building computers and fixing technical problems. Aaron enjoyed writing simple programs. Both planned to enroll in the computer science department at their local universities and pursue careers in information technology.

But now, as high school graduation draws near, neither student is sure what to do. They've heard about computer jobs being moved to other countries, even as technology seems pervasive in everyday life. Will there be opportunities in information technology? Will jobs be moved abroad? Is computer-related training a bad investment of time and money?

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# in information technology

Amari and Aaron are not alone in their uncertainty. In recent years, students, workers, and jobseekers have received mixed signals about the job market for information technology. Periods of strong job growth have been punctuated by brief periods of employment declines. Optimism about information technology, commonly referred to as IT, as a career field has been tempered by concerns about job security and competition abroad. Jobseekers and students, unsure of what the future holds, are understandably confused about the direction in which IT careers are headed.

But, as this analysis shows, the IT field continues to offer opportunities for jobseekers who have the right skills and training. The good news for Amari and Aaron is that most IT occupations are expected to remain in high demand and have strong job growth.

Data in this article are from the U.S. Bureau of Labor Statistics (BLS)—includ-

ing the Current Population Survey and the Occupational Statistics and Employment Projections program. Keep reading for an overview of some information technology occupations studied by BLS. There's also a discussion of past employment, future prospects, and education and training for IT workers. A final section provides sources of more information.

## Who are IT workers?

There is no universal definition of the IT workforce. For purposes of this article, IT workers are grouped into 10 selected occupations commonly identified for their computer-related focus. These occupations are in nearly all areas of the country and in nearly all types of organizations. Workers in most of the occupations are in demand—and, as a group, earned wages that were almost twice the national average of \$40,690 in May 2007, according to BLS.

**Computer and information research scientists** explore new ideas in information technology. They create and refine the theories that are the starting point for many computer products and systems.

**Computer and information systems managers** are in charge of the computer systems in an organization. They determine which IT products the organization needs—such as computers, networks, and software—and supervise the workers who operate these products.

**Computer hardware engineers** design computer hardware, such as computer chips, circuits, and drives. These engineers' products are in personal computers, cellular phones, and cars, among other equipment.

**Computer software engineers** design computer software. They analyze the needs of computer software users and then design, develop, and test software to meet those needs.

**Computer programmers** translate the designs of software engineers into computer code—a language that the computer understands. This code tells the computer what to do, such as to navigate to a Web page when the user clicks on a link to that page.

**Database administrators** determine the best way to organize and store data. They deploy and maintain database software systems and take steps to ensure that the data remain secure.

**Network systems and data communications analysts** plan, design, and test computer systems. They also design new ways for computer systems to share information.

**Computer systems analysts** help businesses and other organizations select the best products for their computing needs. They determine which types of systems and software will help an organization reach its goals and recommend ways to keep the systems safe.

**Network and computer systems administrators** oversee the computer networks and systems in an organization. They make sure that computer systems run efficiently, and they maintain system security.

**Computer support specialists** fix technical problems for computer users. Some of

these workers run diagnostic programs and perform network maintenance. Others answer users' technical questions or install computer equipment in customers' homes or businesses.

## IT employment facts and fallacies

Job prospects in information technology, like those in many career fields, vary by occupation. Some computer jobs were eliminated when their tasks moved overseas—a business practice known as offshoring. Although offshoring affected only a few IT occupations, many people were concerned that information technology as a whole was in distress.

**Technology jobs timeline.** In the 1990s, technology became a larger part of everyday life. As personal and business use of computers and the Internet grew, so did demand for IT services. Employers hired IT workers at a rapid pace throughout the decade to meet this demand.

Then, in 2001, employment in IT services began to decline. Studies suggest that many students believed that this decline would be permanent. Students feared that demand for IT services would fall, resulting in poor job prospects for IT workers. And when reports of IT offshoring became widespread, students began to believe that a significant number of technology jobs were being moved abroad. Enrollment in computer-related majors fell.

However, Current Population Survey data show that these concerns were largely unfounded. Overall, employment in IT occupations grew by about 8 percent between 2001 and 2007.

In 2001, IT employment reached about 3.54 million workers. In 2002, that number dipped to about 3.37 million. This decline was at least partly the result of the downturn in Internet-related ventures.

But in 2003, employment began to increase again, and by 2006 there were more IT workers in the United States than the previous high in 2001. Employment continued to go up, reaching 3.84 million workers in 2007.

As these data show, the demand for IT workers continued to increase over time, despite offshoring. An analysis of the factors



affecting employment helps explain why.

**Factors affecting employment.** Recent IT employment patterns have varied by occupation. This variation is a result of several factors, including demand for certain IT services, increasing efficiency in particular fields, and different susceptibilities to offshoring. For example, employment of database administrators, computer and information systems managers, and computer software engineers all grew by 22 percent or more between 2001 and 2007. Computer scientists and systems analysts, network and computer systems administrators, and network and data communications analysts also saw employment growth, with increases between 8 and 16 percent over the same period.

Employment in some occupations did fall, however. Computer programmers and computer support specialists, for example, both saw job losses of more than 6 percent. These two occupations are more susceptible to offshoring than other IT occupations, according to BLS, because their tasks are routine, can be done by telephone or over the Internet, require little interaction with other types of workers,

and require little familiarity with the cultural practices of customers.

Although offshoring may have contributed to job losses in those occupations, it is likely that other factors also played a part in their employment declines. For example, some programming and support functions that were previously performed by IT workers have been automated. This automation has lowered demand for workers in these occupations, resulting in job losses.

Apart from those two occupations, offshoring's impact on technology jobs has probably been limited. A report by the Association for Computing Machinery states that in previous years, IT jobs in which workers need comparatively lower levels of skill—such as programmers and support specialists—were the primary focus of offshoring efforts; meanwhile, other occupations that require higher level skills were largely unaffected.

Furthermore, the same factors that allow U.S. firms to move work to other countries allow foreign businesses to hire workers in the United States, thus creating jobs. Raymond R. Panko, a professor of IT management at the



University of Hawaii, asserts that more jobs may have been gained through this process than lost through offshoring.

### Future prospects

Every 2 years, the BLS Occupational Statistics and Employment Projections program produces long-term employment projections for occupations, industries, the labor force, and the overall economy. Data from the most recent set of projections indicates that the outlook for technology jobs is relatively bright.

Employment in combined IT occupations is expected to increase by more than 800,000 jobs over the 2006–16 projections decade. This increase represents expected job growth of 24 percent—compared with 10 percent growth for all occupations. So, opportunities should be plentiful for workers who hope to enter the IT field.

IT workers are needed in nearly all types



of organizations, from retail establishments to manufacturing plants. As IT operations expand across the economy, demand for IT workers should expand along with them.

Although offshoring is likely to continue, BLS research suggests that job opportunities in information technology will continue to be excellent. And a study by the Association for Computing Machinery finds that even though offshoring may increase, prospects for IT workers in the United States will be strong.

As the chart shows, employment in several IT occupations is expected to grow especially fast over the 2006–16 decade. With a projected employment increase of 53 percent—more than 5 times the rate for all occupations—network systems and data communications analyst is projected to be the fastest growing IT occupation. It's also projected to be the fastest growing of all occupations in the United States. As businesses and other organizations continue to adopt newer, more efficient computer networks, these workers will be in high demand.

But one occupation is expected to see employment declines. Employment of computer programmers is projected to decrease by 4 percent from 2006–16. Continued offshoring in this occupation, as well as increased efficiency, will reduce demand for programming services during the projections decade.

### Preparation for IT careers

How can someone get started in an IT career? There are many paths. Having both general and specific skills is helpful. But for many jobs, formal training is essential.

During the technology boom of the 1990s, workers with no more than a high school diploma reportedly could land a high-paying job in a wide array of computer occupations. Now, however, most employers prefer applicants who have at least a bachelor's degree. Certification, which may be required in some jobs, is also available.

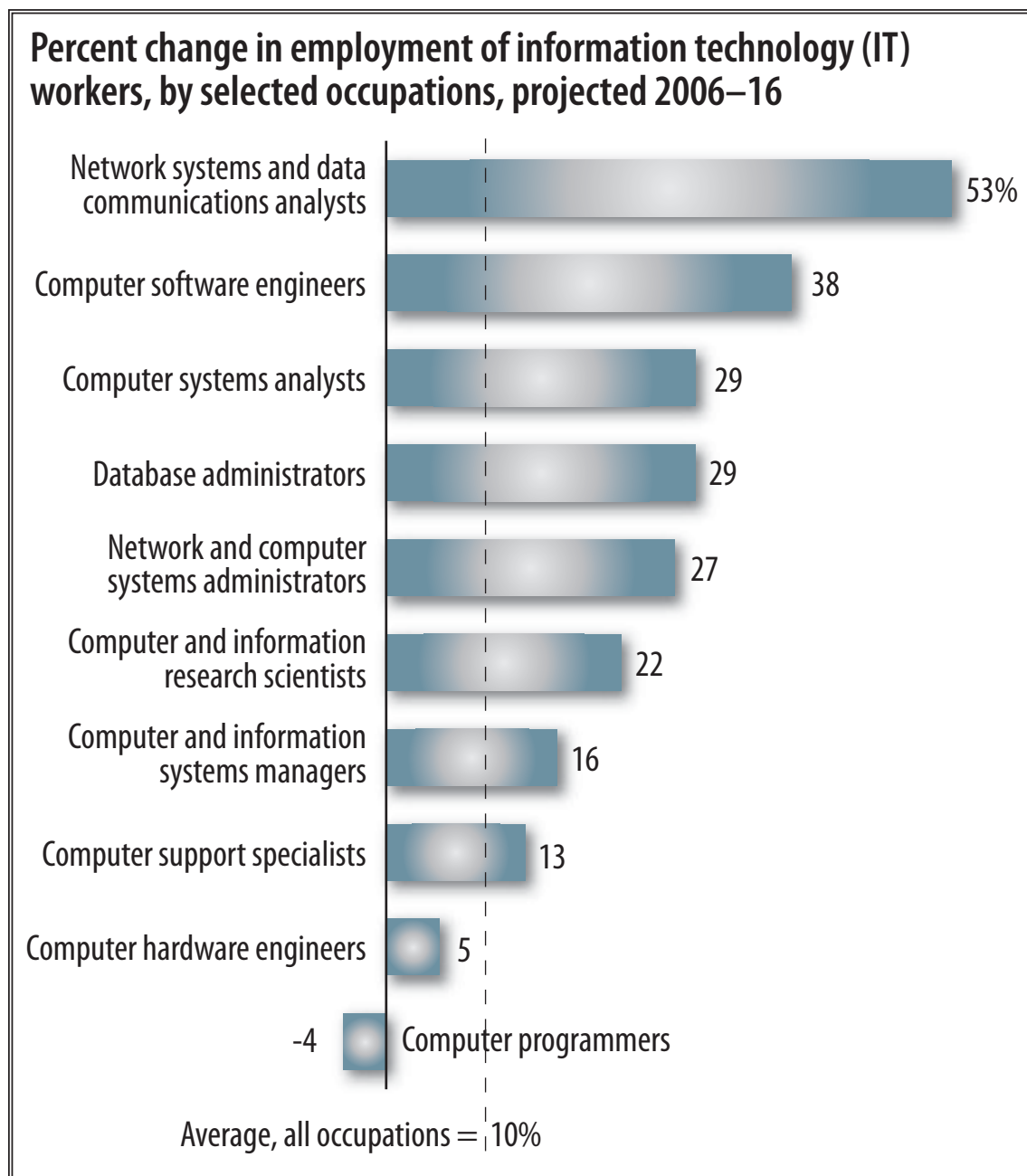
**Skills.** A general foundation, such as ease with computers and a curiosity about how they work, is important for working in IT. And several specific skills may be helpful

for a variety of IT occupations, especially for those that are expected to remain in demand. Among these skills is business aptitude and proficiency in wireless networking; knowledge of information security also is recommended. In addition, problem-solving skills and attention to detail are essential in all areas of IT. Students can begin gaining some of these skills as early as high school.

Business aptitude is useful as profitability, project management, and cost-benefit analy-

ses increasingly become the responsibility of a number of IT workers, such as computer and information systems managers. High school classes in mathematics are helpful for establishing a strong foundation for IT training and for business-related subjects ranging from accounting to finance.

As technology improves, and cell phones and other wireless devices gain networking capabilities, people increasingly seek access to the Internet. As demand for mobile access



continues to grow, workers who are proficient in wireless networking will be in high demand. Workers in this area need to be detail oriented to effectively design, install, and maintain wireless networks and systems.

Protecting information systems and data from the threat of cyberspace criminals is important to businesses and other organizations. Specialized training prepares IT workers to gain expertise in security issues.

**Degrees.** A bachelor's degree is the usual minimum qualification for many IT jobs. Many entry-level software engineers and computer systems analysts, for example, are required to have a bachelor's degree. Those who do the most complex tasks may need a master's degree. In 2007, according to BLS, almost 70 percent of IT workers had a bachelor's or higher degree.

The most applicable degrees for IT jobs are those in computer science, computer engineering, software engineering, or information systems. But many other types of degrees can lead to a career in information technology. According to the National Science Foundation's 2006 science and engineering workforce surveys, almost 66 percent of IT workers indicated that their highest degree was in a field other than computer and information sciences. These fields included management, electrical and computer engineering, mathematics, and arts and humanities.

Not all IT workers need a bachelor's degree, however. One example is computer support specialists. Jobs in this occupation may be open to applicants who have a high school diploma, some college, or an associate degree.

**Certification.** Certification demonstrates a level of proficiency in a product or subject. Certification programs usually require candidates to take a test or a series of tests; a passing score represents to employers an IT applicant's or worker's knowledge and skills. Some programs allow candidates to study on their own for these tests, and others offer test-preparation courses.

Certification is offered by IT product vendors and professional organizations. IT

product vendors generally offer certification in the computer software or hardware they produce. Some vendors require certification for people who work with their products.

Professional organizations offer voluntary certification programs in a broad range of subjects. Popular topics include wireless networking and information security. Before entering such programs or paying any fees, workers should research the program to determine its reputation within the IT community.

### For more information

Visit your local library or school's career counseling office to learn more about IT occupations. The *Occupational Outlook Handbook*, available in many libraries and online at [www.bls.gov/ooh](http://www.bls.gov/ooh), provides in-depth information about the occupations described in this article.

For a recent BLS analysis of offshoring, see the December 2008 *Monthly Labor Review* article "Service-providing occupations, offshoring, and the labor market," available online at [www.bls.gov/opus/mlr/2008/12/art4full.pdf](http://www.bls.gov/opus/mlr/2008/12/art4full.pdf).

The following organizations are among the many that offer further information on IT careers, training programs, and certification:

Institute of Electrical and Electronics Engineers Computer Society  
1828 L St. NW.  
Washington, DC 20036  
(202) 371-0101  
[help@computer.org](mailto:help@computer.org)  
[www.computer.org](http://www.computer.org)

Association for Computing Machinery  
2 Penn Plaza, Suite 701  
New York, NY 10121  
[acmhelp@acm.org](mailto:acmhelp@acm.org)  
[computingcareers.acm.org](http://computingcareers.acm.org)

CompTIA  
1815 S. Meyers Rd., Suite 300  
Oakbrook Terrace, IL 60181  
(630) 678-8300  
[www.comptia.org/trainingandeducation/default.aspx](http://www.comptia.org/trainingandeducation/default.aspx)



CWNP (Certified Wireless Network Professional)  
4381 Beech Haven Trail, Suite 400  
Smyrna, GA 30080  
(770) 433-9339  
[www.cwnp.com](http://www.cwnp.com)

Cisco Systems, Inc.  
170 W. Tasman Dr.  
San Jose, CA 95134  
Toll free: 1 (800) 553-NETS (6387)  
(408) 526-4000  
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Redmond, WA 98052  
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default.mspx](http://www.microsoft.com/learning/mcp/default.mspx)

