Computer Scientists and Database Administrators

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Significant Points

- Education requirements range from an associate degree to a doctoral degree.
- Employment is expected to increase much faster than the average as organizations continue to expand their use of technology.
- Workers must be able to learn new technologies quickly for these constantly evolving occupations.

Nature of the Work

The rapid and widespread use of computers and information technology has generated a need for highly trained workers proficient in various job functions. These computer specialists include computer scientists, database administrators, and network systems and data communication analysts. Job tasks and occupational titles used to describe these workers evolve rapidly and continually, reflecting new areas of specialization or changes in technology, as well as the preferences and practices of employers.

Computer scientists work as theorists, researchers, or inventors. Their jobs are distinguished by the higher level of theoretical expertise and innovation they apply to complex problems and the creation or application of new technology. The areas of computer science research range from complex theory to hardware design to programming-language design. Some researchers work on multidisciplinary projects, such as developing and advancing uses of virtual reality, extending human-computer interaction, or designing robots. They may work on design teams with electrical engineers and other specialists.

Computer science researchers employed by academic institutions (covered in the statement on teachers—postsecondary, elsewhere in the *Handbook*) have job functions that are similar in many ways to those employed by other organizations. In general, researchers in academic settings have more flexibility to focus on pure theory, while those working in other organizations usually focus on projects that have the possibility of producing patents and profits. However, some researchers in non-academic settings have considerable latitude in determining the direction of their research.

With the Internet and electronic business generating large volumes of data, there is a growing need to be able to store, manage, and extract data effectively. *Database administrators* work with database management systems software and determine ways to organize and store data. They identify user needs and set up new computer databases. In many cases, database administrators must integrate data from outdated systems into a new system. They also test and coordinate modifications to the system when needed, and troubleshoot problems when they occur. An organization's database administrator ensures the performance of the system, understands the platform on which the database runs, and adds new users to the system. Because many databases are connected to the Internet, database administrators also must plan and coordinate security measures with network administrators. With the growing volume of sensitive data and the increasing interconnectedness of computer networks, data integrity, backup systems, and database security have become increasingly important aspects of the job of database administrators.

Network systems and data communications analysts, also referred to as *network architects*, design, test, and evaluate systems such as local area networks (LANs), wide area networks (WANs), the Internet, intranets, and other data communications systems. Systems are configured in many ways and can range from a connection between two offices in the same building to globally distributed networks, voice mail, and e-mail systems of a multinational organization. Network systems and data communications analysts perform network modeling, analysis, and planning, often requiring both hardware and software solutions. For example, a network may involve the installation of several pieces of hardware, such as routers and hubs, wireless adaptors, and cables, while also requiring the installation and configuration of software, such as network drivers. Analysts also may research related products and make necessary hardware and software recommendations.

Telecommunications specialists focus on the interaction between computer and communications equipment. These workers design voice and data communication systems, supervise the installation of the systems, and provide maintenance and other services to clients after the systems are installed.

Computer scientists work at the very forefront of technology.

The growth of the Internet and the expansion of the World Wide Web (the graphical portion of the Internet) have generated a variety of occupations related to the design, development, and maintenance of Web sites and their servers. For example, *webmasters* are responsible for all technical aspects of a Web site, including performance issues such as speed of access, and for approving the content of the site. *Internet developers* or *Web developers*, also called *Web designers*, are responsible for day-to-day site creation and design.

Work environment. Computer scientists and database administrators normally work in offices or laboratories in comfortable surroundings. They typically work about 40 hours a week, the same as many other professional or office workers. However, evening or weekend work may be necessary to meet deadlines or to solve specific problems. Telecommuting is increasingly common for many computer professionals as networks expand, allowing more work to be done from remote locations through modems, laptops, electronic mail, and the Internet. However, some work still must be done in the office for security or other reasons.

Like other workers who spend long periods in front of a computer terminal typing on a keyboard, computer scientists and database administrators are susceptible to eyestrain, back discomfort, and hand and wrist problems such as carpal tunnel syndrome or cumulative trauma disorder.

Training, Other Qualifications, and Advancement

Rapidly changing technology requires an increasing level of skill and education on the part of workers in these occupations. Employers look for professionals with an ever-broader background and range of skills, including technical knowledge and also communication and other interpersonal skills.

Education and training. While there is no universally accepted way to prepare for a job as a network systems analyst, computer scientist, or database administrator, most employers place a premium on some formal college education. A bachelor's degree is a prerequisite for many jobs; however, some jobs may require only a 2-year degree. Relevant work experience also is very important. For more technically complex jobs, persons with graduate degrees are preferred. Most computer scientist positions require a Ph.D. degree, as their main job function is research. Computer scientists having only a bachelor's or master's degree are generally limited in their ability to advance.

For database administrator and network systems and data communication analyst positions, most employers seek applicants who have bachelor's degrees in computer science, information science, or management information systems (MIS). MIS programs usually are part of the business school or college and differ considerably from computer science programs, emphasizing business and management-oriented coursework and business computing courses. Employers increasingly prefer applicants with a master's degree in business administration (MBA) with a concentration in information systems, as more firms move their business to the Internet. For some network systems and data communication analysts, such as webmasters, an associate degree or certificate is sufficient, although more advanced positions might require a computer-related bachelor's degree.

Most community colleges and many independent technical institutes and proprietary schools offer an associate's degree in computer science or a related information technology field. Many of these programs may be geared more toward meeting the needs of local businesses and are more occupation specific than are 4-year degree programs. Some jobs may be better suited to the level of training that such programs offer. Employers usually look for people who have broad knowledge and experience related to computer systems and technologies, strong problem-solving and analytical skills, and good interpersonal skills. Courses in computer science or systems design offer good preparation for a job in these computer occupations. For jobs in a business environment, employers usually want systems analysts to have business management or closely related skills, while a background in the physical sciences, applied mathematics, or engineering is preferred for work in scientifically oriented organizations. Art or graphic design skills may be desirable for webmasters or Web developers.

Despite employers' preference for those with technical degrees, individuals with post-secondary degrees in a variety of other subjects may find employment in these occupations. Given the rapid pace of technological change, a degree generally has more value as a demonstration of an individual's ability to learn, rather than as a certification of a certain skill set. Generally speaking, coursework in computer science and an undergraduate degree are sufficient qualifications, especially if the applicant has a reasonable amount of experience.

Certification and other qualifications. Computer scientists and database administrators must be able to think logically and have good communication skills. Because they often deal with a number of tasks simultaneously, the ability to concentrate and pay close attention to detail also is important. Although computer specialists sometimes work independently, they frequently work in teams on large projects. As a result, they must be able to communicate effectively with computer personnel, such as programmers and managers, as well as with users or other staff who may have no technical computer background.

Jobseekers can enhance their employment opportunities by earning certifications, most of which are offered through private companies, with many related to specific products. Many employers regard these certifications as the industry standard. For example, one method of acquiring enough knowledge to get a job as a database administrator is to become certified in database management with a certain software package. Voluntary certification also is available through various organizations associated with computer specialists. Professional certification may afford a jobseeker a competitive advantage.

Because technology is so closely connected to the functioning of businesses, many workers in these occupations come from elsewhere in the business or industry to become computer specialists. This background can be very useful, in that it helps them to better understand how their networking and database tools are being used within the organization.

Advancement. Computer scientists may advance into managerial or project leadership positions. Many having advanced degrees choose to leave private industry for academic posi-

tions. Database administrators may advance into managerial positions, such as chief technology officer, on the basis of their experience managing data and enforcing security. Computer specialists with work experience and considerable expertise in a particular subject or a certain application may find lucrative opportunities as independent consultants or may choose to start their own computer consulting firms.

Technological advances come so rapidly in the computer field that continuous study is necessary to keep one's skills up to date. Employers, hardware and software vendors, colleges and universities, and private training institutions offer continuing education. Additional training may come from professional development seminars offered by professional computing societies.

Employment

Computer scientists and database administrators held about 542,000 jobs in May 2006, including about 58,000 who were self-employed. Employment was distributed among the detailed occupations as follows:

Network systems and data communication analysts.....262,000
Computer specialists, all other.....136,000
Database administrators.....119,000
Computer and information scientists, research.....25,000

Although they are increasingly employed in every sector of the economy, the greatest concentration of these workers is in the computer systems design and related services industry. Firms in this industry provide services related to the commercial use of computers on a contract basis, including custom computer programming services; computer systems integration design services; computer facilities management services, including computer systems or data processing facilities support services for clients; and other computer-related services, such as disaster recovery services and software installation. Many computer scientists and database administrators are employed by Internet service providers; Web search portals; and data processing, hosting, and related services firms. Others work for government, manufacturers of computer and electronic products, insurance companies, financial institutions, and universities.

A growing number of computer specialists, such as network and data communications analysts, are employed on a temporary or contract basis; many of these individuals are self-employed, working independently as contractors or consultants. For example, a company installing a new computer system may need the services of several network systems and data communication analysts just to get the system running. Because not all of the analysts would be needed once the system is functioning, the company might contract for such employees with a temporary help agency or consulting firm, or with the network systems analysts themselves. Such jobs may last from several months to 2 years or more. This growing practice enables companies to bring in people with the exact skills they need to complete a particular project, rather than having to spend time or money training or retraining existing workers. Often, experienced consultants then train a company's in-house staff as a project develops.

Job Outlook

Computer scientists and database administrators are projected to be one of the fastest growing occupations over the next decade. Strong employment growth combined with a limited supply of qualified workers will result in excellent employment prospects for this occupation and a high demand for their skills.

Employment change. The computer scientists and database administrators occupation is expected to grow 37 percent from 2006 to 2016, much faster than average for all occupations. Employment of these computer specialists is expected to grow as organizations continue to adopt and integrate increasingly sophisticated technologies. Job increases will be driven by very rapid growth in computer systems design and related services, which is projected to be one of the fastest growing industries in the U.S. economy.

The demand for networking to facilitate the sharing of information, the expansion of client-server environments, and the need for computer specialists to use their knowledge and skills in a problem-solving capacity will be major factors in the rising demand for computer scientists and database administrators. Firms will continue to seek out computer specialists who are able to implement the latest technologies and are able to apply them to meet the needs of businesses as they struggle to maintain a competitive advantage.

As computers continue to become more central to business functions, more sophisticated and complex technology is being implemented across all organizations, fueling demand for computer scientists and database administrators. There is growing demand for network systems and data communication analysts to help firms maximize their efficiency with available technology. Expansion of electronic commerce—doing business on the Internet—and the continuing need to build and maintain databases that store critical information on customers, inventory, and projects are fueling demand for database administrators

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Computer scientists and database administrators	—	542,000	742,000	200,000	37
Computer and information scientists, research	15-1011	25,000	31,000	5,400	22
Database administrators	15-1061	119,000	154,000	34,000	29
Network systems and data communications analysts	15-1081	262,000	402,000	140,000	53
Computer specialists, all other	15-1099	136,000	157,000	21,000	15

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

familiar with the latest technology. Because of the increasing reliance on the Internet among businesses, information security is an increasing concern.

The development of new technologies leads to demand for various kinds of workers. The expanding integration of Internet technologies into businesses, for example, has resulted in a growing need for specialists who can develop and support Internet and intranet applications. The growth of electronic commerce means that more establishments use the Internet to conduct their business online. It also means more security specialists are needed to protect their systems. The spread of such new technologies translates into a need for information technology professionals who can help organizations use technology to communicate with employees, clients, and consumers. Explosive growth in these areas also is expected to fuel demand for specialists who are knowledgeable about network, data, and communications security.

Job prospects. Computer scientists and database administrators should continue to enjoy excellent job prospects. As technology becomes more sophisticated and complex, however, these positions will demand a higher level of skill and expertise from their employees. Individuals with an advanced degree in computer science or computer engineering or with an MBA with a concentration in information systems should enjoy favorable employment prospects. College graduates with a bachelor's degree in computer science, computer engineering, information science, or MIS also should enjoy favorable prospects, particularly if they have supplemented their formal education with practical experience. Because employers continue to seek computer specialists who can combine strong technical skills with good business skills, individuals with a combination of experience inside and outside the IT arena will have the best job prospects.

In addition to growth, many job openings will arise from the need to replace workers who move into managerial positions or other occupations or who leave the labor force.

Earnings

Median annual earnings of computer and information scientists, research, were $93,950 in May 2006. The middle 50 percent earned between $71,930 and $118,100. The lowest 10 percent earned less than $53,590, and the highest 10 percent earned more than $144,880. Median annual earnings of computer and information scientists employed in computer systems design and related services in May 2006 were $95,340.

Median annual earnings of database administrators were $64,670 in May 2006. The middle 50 percent earned between $48,560 and $84,830. The lowest 10 percent earned less than $37,350, and the highest 10 percent earned more than $103,010. In May 2006, median annual earnings of database administrators employed in computer systems design and related services were $72,510, and for those in management of companies and enterprises, earnings were $67,680.

Median annual earnings of network systems and data communication analysts were $64,600 in May 2006. The middle 50 percent earned between $49,510 and $82,630. The lowest 10 percent earned less than $38,410, and the highest 10 percent earned more than $101,740. Median annual earnings in the industries employing the largest numbers of network systems and data communications analysts in May 2006 are shown below:

Wired telecommunications carriers	$72,480
Management of companies and enterprises	68,490
Management, scientific, and technical consulting services	67,830
Computer systems design and related services	67,080
State government	52,020

Median annual earnings of all other computer specialists were $68,570 in May 2006. Median annual earnings of all other computer specialists employed in computer systems design and related services were $67,370, and, for those in management of companies and enterprises, earnings were $63,610 in May 2006.

Robert Half International, a firm providing specialized staffing services, noted the following salary ranges for computer-related occupations in their 2007 Salary Guide:

Database manager	$84,750 - $116,000
Network architect	78,000 - 112,250
Database developer	73,500 - 103,000
Senior web developer	71,000 - 102,000
Database administrator	70,250 - 102,000
Network manager	68,750 - 93,000
Web developer	54,750 - 81,500
LAN/WAN administrator	51,000 - 71,500
Web administrator	49,750 - 74,750
Web designer	47,000 - 71,500
Telecommunications specialist	47,500 - 69,500

Related Occupations

Others who work with large amounts of data are computer programmers, computer software engineers, computer and information systems managers, engineers, mathematicians, statisticians, and actuaries.

Sources of Additional Information

Further information about computer careers is available from:

➤ Association for Computing Machinery (ACM), 1515 Broadway, New York, NY 10036.
Internet: **http://www.acm.org**

➤ Institute of Electrical and Electronics Engineers Computer Society, Headquarters Office, 1730 Massachusetts Ave. NW., Washington, DC 20036-1992.
Internet: **http://www.computer.org**

➤ Software & Information Industry Association, 1090 Vermont Ave. NW., 6th floor, Washington, DC 20005.
Internet: **http://www.siia.net**