2018 IT OCCUPATIONAL OUTLOOK

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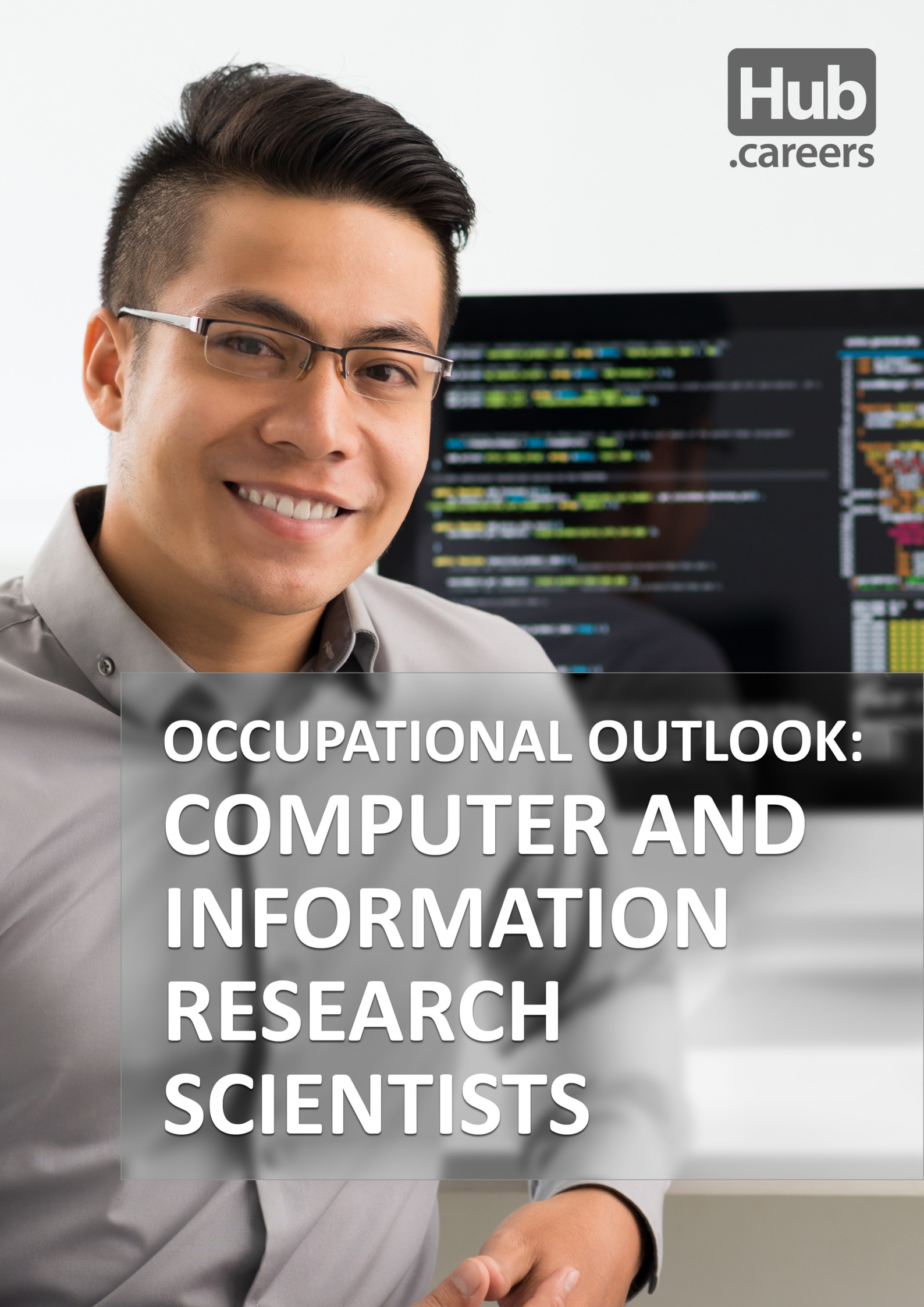

OCCUPATIONAL OUTLOOK: COMPUTER AND INFORMATION RESEARCH SCIENTISTS

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Computer and Information Research Scientists

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Computer and Information Research Scientists

Computer and information research scientists study and solve complex problems in computing.

Quick Facts: Computer and Information Research Scientists	
2014 Median Pay	$108,360 per year $52.09 per hour
Typical Entry-Level Education	Doctoral or professional degree
Work Experience in a Related Occupation	None
On-the-job Training	None
Number of Jobs, 2014	25,600
Job Outlook, 2014-24	11% (Faster than average)
Employment Change, 2014-24	2,700

What Computer and Information Research Scientists Do

Computer and information research scientists invent and design new approaches to computing technology and find innovative uses for existing technology. They study and solve complex problems in computing for business, medicine, science, and other fields.

Work Environment

Most computer and information research scientists work full time. About 1 in 10 worked more than 40 hours per week in 2014.

How to become a Computer and Information Research Scientist

Most jobs for computer and information research scientists require a Ph.D. in computer science or a related field. In the federal government, a bachelor's degree may be sufficient for some jobs.

Pay

The median annual wage for computer and information research scientists was $108,360 in May 2014.

Job Outlook

Employment of computer and information research scientists is projected to grow 11 percent from 2014 to 2024, faster than the average for all occupations. Computer scientists are likely to enjoy excellent job prospects, because many companies report difficulties finding these highly skilled workers.

State & Area Data

Explore resources for employment and wages by state and area for computer and information research scientists.

Similar Occupations

Compare the job duties, education, job growth, and pay of computer and information research scientists with similar occupations.

More Information, Including Links to O*NET

Learn more about computer and information research scientists by visiting additional resources, including O*NET, a source on key characteristics of workers and occupations.

What Computer and Information Research Scientists Do

Some computer scientists create programs to control robots.

Computer and information research scientists invent and design new approaches to computing technology and find innovative uses for existing technology. They study and solve complex problems in computing for business, science, medicine, and other fields.

Duties

Computer and information research scientists typically do the following:

- Explore fundamental issues in computing and develop theories and models to address those issues

- Help scientists and engineers solve complex computing problems
- Invent new computing languages, tools, and methods to improve the way in which people work with computers
- Develop and improve the software systems that form the basis of the modern computing experience
- Design experiments to test the operation of these software systems
- Analyze the results of their experiments
- Publish their findings in academic journals and present their findings at conferences

Computer and information research scientists create and improve computer software and hardware.

Creating and improving software involves working with algorithms, which are sets of instructions that tell a computer what to do. Some computer tasks are very difficult and require complex algorithms. Computer and information research scientists try to simplify these algorithms to make computer systems as efficient as possible. The algorithms allow advancements in many types of technology, such as machine learning systems and cloud computing.

Computer and information research scientists design new computer architecture that improves the performance and efficiency of computer hardware. Their work often leads to technological advancements and efficiencies, such as better networking technology, faster computing speeds, and improved information security. In general, computer and information research scientists work at a more theoretical level than do other computer professionals.

Many people with a computer and information research science background become postsecondary teachers. In general, researchers in an academic setting focus on computer theory, although those working for businesses or

scientific organizations usually focus on projects that may produce profits. Some computer scientists work with electrical engineers, computer hardware engineers, and other specialists on multidisciplinary projects.

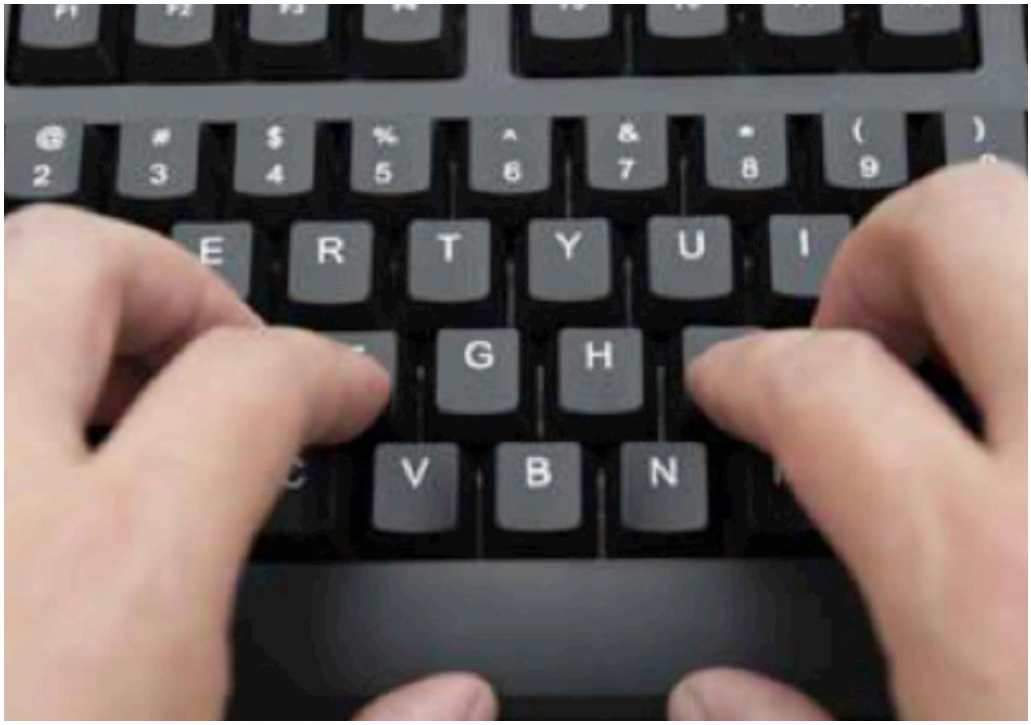
The following are examples of types of specialties for computer and information research scientists:

Data mining. Computer and information research scientists write algorithms that are used to detect and analyze patterns in very large datasets. They improve ways to sort, manage, and display data. Computer scientists build algorithms into software packages that make the data easier for analysts to use. For example, they may create an algorithm to analyze a very large set of medical data in order to find new ways to treat diseases. They may also look for patterns in traffic data to help clear accidents faster.

Robotics. Some computer and information research scientists study how to improve robots. Robotics explores how a machine can interact with the physical world. Computer and information research scientists create the programs that control the robots. They work closely with engineers who focus on the hardware design of robots. Together, these workers test how well the robots do the tasks they were created to do, such as assemble cars and collect data on other planets.

Programming. Computer and information research scientists design new programming languages that are used to write software. The new languages make software writing more efficient by improving an existing language, such as Java, or by making a specific aspect of programming, such as image processing, easier.

Work Environment



Computer and information research scientists improve ways to sort, manage, and display data.

Computer and information research scientists held about 25,600 jobs in 2014. The industries that employed the most computer and information research scientists were as follows:

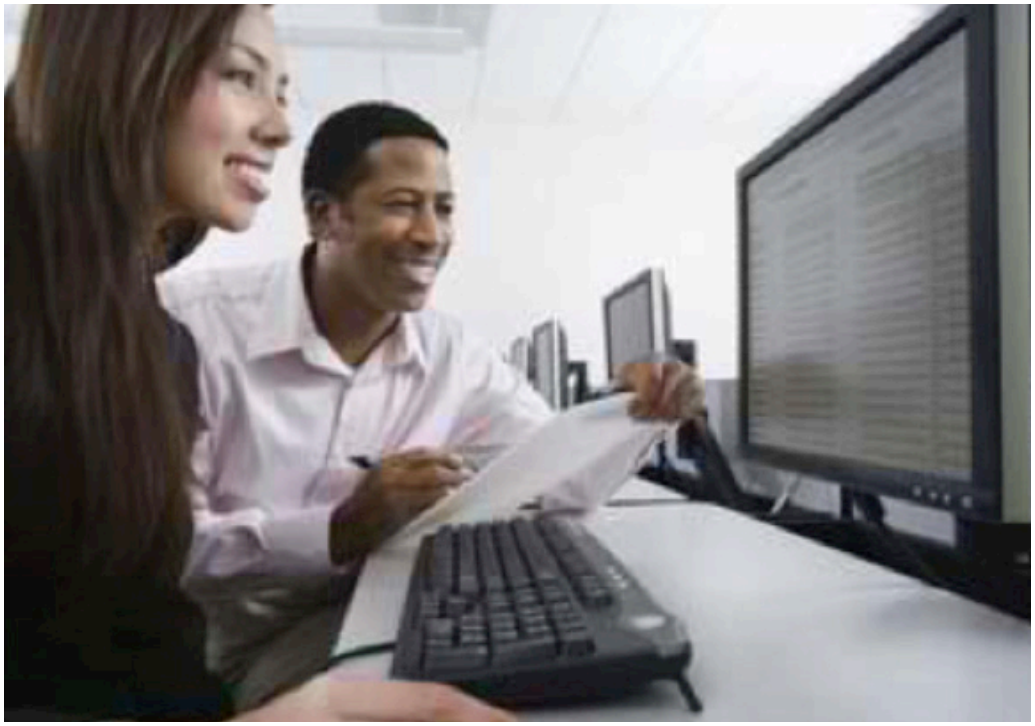
Federal government, excluding postal service	28%
Computer systems design and related services	18
Information	14
Research and development in the physical, engineering, and life sciences	12
Colleges, universities, and professional schools; state, local, and private	11

Most computer scientists employed by the federal government work for the Department of Defense.

Work Schedules

Most computer and information research scientists work full time. About 1 in 10 worked more than 40 hours per week in 2014.

How to become a Computer and Information Research Scientist



Some computer scientists specialize in computer languages.

Most jobs for computer and information research scientists require a Ph.D. in computer science or a related field. In the federal government, a bachelor's degree may be sufficient for some jobs.

Education

Most computer and information research scientists need a Ph.D. in computer science or a related field, such as computer engineering. A Ph.D. usually requires 4 to 5 years of study after earning a bachelor's degree, typically in a computer-related field, such as computer science or information systems. During their first 2 years in a Ph.D. program, students take a variety of computer science classes. They then choose a specialty and spend the remaining years in the program doing research within that specialty.

Computer scientists who work in a specialized field may need knowledge of that field. For example, those working on biomedical applications may have to take some biology classes.

Advancement

Some computer scientists may become computer and information systems managers.

Important Qualities

Analytical skills. Computer and information research scientists must be organized in their thinking and analyze the results of their research to formulate conclusions.

Communication skills. Computer and information research scientists must communicate well with programmers and managers and be able to clearly explain their conclusions to people with no technical background. They often present their research at conferences.

Critical-thinking skills. Computer and information research scientists work on many complex problems.

Detail oriented. Computer and information research scientists must pay close attention to their work, because a small programming error can cause an entire project to fail.

Ingenuity. Computer and information research scientists must continually come up with innovative ways to solve problems, particularly when their ideas do not initially work as intended.

Logical thinking. Computer algorithms rely on logic. Computer and information research scientists must have a talent for reasoning.

Math skills. Computer and information research scientists must have knowledge of advanced math and other technical topics that are critical in computing.

Pay

Computer and Information Research Scientists

Median annual wages, May 2014

Note: All Occupations includes all occupations in the U.S. Economy.
Source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics

The median annual wage for computer and information research scientists was $108,360 in May 2014. The median wage is the wage at which half the workers in an occupation earned more than that amount and half earned less. The lowest 10 percent earned less than $66,030, and the highest 10 percent earned more than $165,600.

In May 2014, the median annual wages for computer and information research scientists in the top industries in which they worked were as follows:

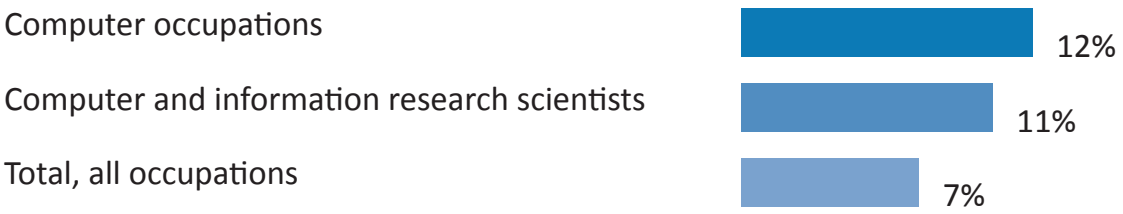
Computer systems design and related services	$117,480
Research and development in the physical, engineering, and life sciences	115,300
Information	112,590
Federal government, excluding postal service	104,390
Colleges, universities, and professional schools; state, local, and private	97,280

Most computer and information research scientists work full time. About 1 in 10 worked more than 40 hours per week in 2014.

Job Outlook

Computer and Information Research Scientists

Percent change in employment, projected 2014-24



Note: All Occupations includes all occupations in the U.S. Economy.
Source: U.S. Bureau of Labor Statistics, Employment Projections program

Employment of computer and information research scientists is projected to grow 11 percent from 2014 to 2024, faster than the average for all occupations.

The research and development work of computer and information research scientists turns ideas into industry-leading technology. As demand for new and better technology grows, demand for computer scientists will grow as well.

Rapid growth in data collection by businesses will lead to an increased need for data-mining services. Computer scientists will be needed to write algorithms that help businesses make sense of very large amounts of data. With this information, businesses understand their consumers better, making the work of computer and information research scientists increasingly vital.

A growing emphasis on cybersecurity also should lead to new jobs, because computer scientists will be needed to find innovative ways to prevent cyberattacks.

In addition, an increase in demand for software may increase the need for computer scientists who create new programming languages to make software writing more efficient.

Job Prospects

Computer and information research scientists are likely to have excellent job prospects. There are a limited number of Ph.D. graduates each year. As a result, many companies report difficulties finding these highly skilled workers. Later in the decade, prospects will be even better, as older computer and information research scientists retire.

For applicants seeking employment in a specialized field, such as finance or biology, knowledge of that field, along with a computer science degree, may be helpful in getting a job.

Employment projections data for Computer and Information Research Scientists, 2014-24

Occupational Title	SOC Code	Employment, 2014	Projected Employment, 2024	Change, 2014-24		Employment by Industry
				Percent	Numeric	
Computer and information research scientists	15-1111	25,600	28,300	11	2,700	[XLSX]
SOURCE: U.S. Bureau of Labor Statistics, Employment Projections program						

State & Area Data

Occupational Employment Statistics (OES)

The Occupational Employment Statistics (OES) program produces employment and wage estimates annually for over 800 occupations. These estimates are available for the nation as a whole, for individual states, and for metropolitan and nonmetropolitan areas. The link(s) below go to OES data maps for employment and wages by state and area.

- Computer and Information Research Scientists

Projections Central

Occupational employment projections are developed for all states by Labor Market Information (LMI) or individual state Employment Projections offices. All state projections data are available at www.projectionscentral.com. Information on this site allows projected employment growth for an occupation to be compared among states or to be compared within one state. In addition, states may produce projections for areas; there are links to each state's websites where these data may be retrieved.

Career InfoNet

America's Career InfoNet includes hundreds of occupational profiles with d ata available by state and metro area. There are links in the left-hand side menu to compare occupational employment by state and occupational wages by local area or metro area. There is also a salary info tool to search for wages by zip code.

Similar Occupations

This table shows a list of occupations with job duties that are similar to those of Computer and Information Research Scientists.

Occupation	Job Duties	ENTRY-LEVEL EDUCATION	2014 MEDIAN PAY
Computer and Information Systems Managers	Computer and information systems managers, often called information technology (IT) managers or IT project managers, plan, coordinate, and direct computer-related activities in an organization. They help determine the information technology goals of an organization and are responsible for implementing computer systems to meet those goals.	Bachelor's degree	$127,640
Computer Hardware Engineers	Computer hardware engineers research, design, develop, and test computer systems and components such as processors, circuit boards, memory devices, networks, and routers. These engineers discover new directions in computer hardware, which generate rapid advances in computer technology.	Bachelor's degree	$108,430
Computer Programmers	Computer programmers write and test code that allows computer applications and software programs to function properly. They turn the program designs created by software developers and engineers into instructions that a computer can follow.	Bachelor's degree	$77,550

Database Administrators	Database administrators (DBAs) use specialized software to store and organize data, such as financial information and customer shipping records. They make sure that data are available to users and are secure from unauthorized access.	Bachelor's degree	$80,280
Mechanical Engineers	Mechanical engineering is one of the broadest engineering disciplines. Mechanical engineers design, develop, build, and test mechanical and thermal sensors and devices, including tools, engines, and machines.	Bachelor's degree	$83,060
Postsecondary Teachers	Postsecondary teachers instruct students in a wide variety of academic and career and technical subjects beyond the high school level. They also conduct research and publish scholarly papers and books.	See How to Become One	$70,790
Software Developers	Software developers are the creative minds behind computer programs. Some develop the applications that allow people to do specific tasks on a computer or another device. Others develop the underlying systems that run the devices or that control networks.	Bachelor's degree	$97,990

Contacts for More Information

For more information about computer and information research scientists, visit

Association for Computing Machinery

IEEE Computer Society

For information about opportunities for women pursuing information technology careers, visit

National Center for Women & Information Technology

O*NET

Computer and Information Research Scientists

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OCCUPATIONAL OUTLOOK: COMPUTER NETWORK ARCHITECTS

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Computer Network Architects

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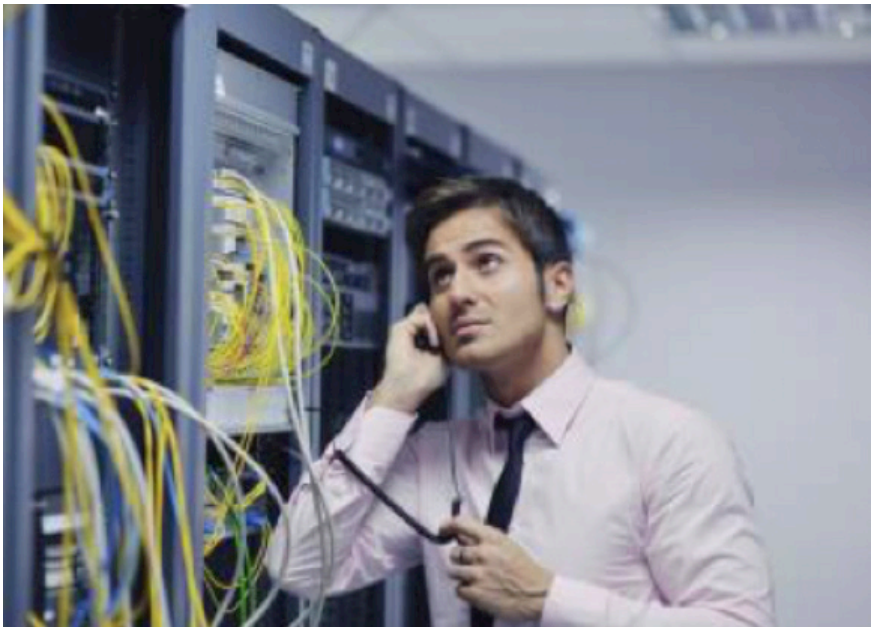
Computer Network Architects

Summary



Computer network architects plan and lay out the internal computer networks used by workers in an organization.

Quick Facts: Computer Network Architects	
2014 Median Pay	$98,430 per year $47.32 per hour
Typical Entry-Level Education	Bachelor's degree
Work Experience in a Related Occupation	5 years or more
On-the-job Training	None
Number of Jobs, 2014	146,200
Job Outlook, 2014-24	9% (Faster than average)
Employment Change, 2014-24	12,700

What Computer Network Architects Do

Computer network architects design and build data communication networks, including local area networks (LANs), wide area networks (WANs), and intranets. These networks range from small connections between two offices to next-generation networking capabilities such as a cloud infrastructure that serves multiple customers.

Work Environment

Most computer network architects work full time. About 1 in 4 worked more than 40 hours per week in 2014.

How to Become an Information Security Analyst

Most computer network architects have a bachelor's degree in a computer-related field and experience in a related occupation, such as network and computer systems administrators.

Pay

The median annual wage for computer network architects was $98,430 in May 2014.

Job Outlook

Employment of computer network architects is projected to grow 9 percent from 2014 to 2024, faster than the average for all occupations. Demand for computer network architects will increase as firms continue to expand their information technology (IT) networks.

State & Area Data

Explore resources for employment and wages by state and area for computer network architects.

Similar Occupations

Compare the job duties, education, job growth, and pay of computer network architects with similar occupations.

More Information, Including Links to O*NET

Learn more about computer network architects by visiting additional resources, including O*NET, a source on key characteristics of workers and occupations.

What Computer Network Architects Do

Network architects design LANs, WANs, and intranets.

Computer network architects design and build data communication networks, including local area networks (LANs), wide area networks (WANs), and intranets. These networks range from small connections between two offices to next-generation networking capabilities such as a cloud infrastructure that serves multiple customers. Network architects must have extensive knowledge of an organization's business plan to design a network that can help the organization achieve its goals.

Duties

Computer network architects typically do the following:

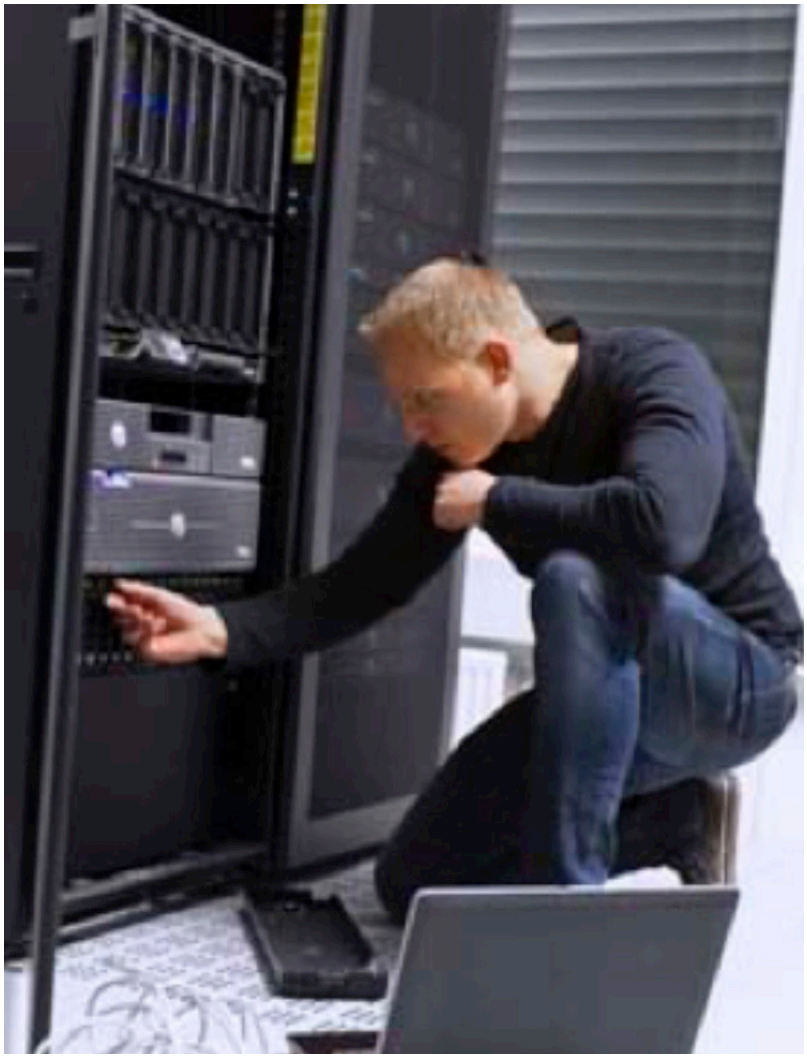
- Create plans and layouts for data communication networks
- Present plans to management and explain why they are in the organization's best interest to pursue them
- Consider information security when designing networks

- Upgrade hardware, such as routers or adaptors, and software, such as network drivers, as needed to support computer networks
- Research new networking technologies to determine what would best support their organization in the future

Computer network architects, or network engineers, often work with their organization's chief technology officer (CTO) to predict where the organization will most need new networks. They spend most of their time planning these new networks. Some computer network architects work with engineers such as computer hardware engineers who help build the network a network architect has designed. Network architects are often experienced staff and have 5 to 10 years of experience working in network administration or with other information technology (IT) systems.

Computer network architects also create models to predict future network needs by analyzing current data traffic and estimating how growth will affect the network. They also keep up to date on new hardware and software technology and test how it can improve network performance. In addition, computer network architects have to keep security in mind and when network vulnerabilities arise, implement security patches or other countermeasures.

Work Environment



Most network architects work full time.

Computer network architects held about 146,200 jobs in 2014. The industries that employed the most computer network architects were as follows:

Computer systems design and related services	26%
Finance and insurance	11
Wired telecommunications carriers	9
Management of companies and enterprises	7
Government	6

Computer network architects spend most of their time in offices, but occasionally work in server rooms where they have access to the hardware that make up an organization's computer and information network.

Work Schedules

Most computer network architects work full time. About 1 in 4 worked more than 40 hours per week in 2014.

How to Become a Sales Manager

Network architects often have several years of experience as a network administrator.

Most computer network architects have a bachelor's degree in a computer-related field and experience in a related occupation, such as network and computer systems administrators.

Education

Computer network architects usually need at least a bachelor's degree in computer science, information systems, engineering, or a related field. Degree programs in a computer-related field give network architects hands-on laboratory work in classes such as network security or database design. These programs prepare network architects to be able to work with the wide array of technologies used in networks.

Employers of network architects sometimes prefer applicants to have a Master's of Business Administration (MBA) in information systems. MBA programs generally require 2 years of study beyond the undergraduate level and include both business and computer-related courses.

Work Experience in a Related Occupation

Network architects generally need to have at least 5 to 10 years of experience working with information technology (IT) systems. They often have experience as anetwork and computer system administrator but also may come from other computer-related occupations such as database administrator or computer systems analyst.

Certification

Certification programs are generally offered by product vendors or software firms. Vendor-specific certification verifies a set of skills to ensure network architects are able to work in specific networking environments. Companies may require their network architects to be certified in the products they use. mine the most effective sales strategies.

Advancement

Some network architects advance to become computer and information systems managers.

Important Qualities

Analytical skills. Computer network architects have to examine data networks and decide how to best connect the networks based on the needs and resources of the organization.

Detail oriented. Computer network architects create comprehensive plans of the networks they are creating with precise information describing how the network parts will work together.

Interpersonal skills. These workers must be able to work with different types of employees to successfully design and implement computer and information networks.

Leadership skills. Many computer network architects direct teams of engineers who build the networks they have designed, such as computer hardware engineers.

Organizational skills. Computer network architects who work for large firms must coordinate many different types of communication networks and make sure they work well together.

Pay

Computer Network Architects

Median annual wages, May 2014

Note: All Occupations includes all occupations in the U.S. Economy.
Source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics

The median annual wage for computer network architects was $98,430 in May 2014. The median wage is the wage at which half the workers in an occupation earned more than that amount and half earned less. The lowest 10 percent earned less than $55,160, and the highest 10 percent earned more than $150,460.

In May 2014, the median annual wages for computer network architects in the top industries in which they worked were as follows:

Finance and insurance	$107,010
Wired telecommunications carriers	104,320
Computer systems design and related services	99,030
Management of companies and enterprises	97,460
Government	71,990

Most computer network architects work full time. About 1 in 4 worked more than 40 hours per week in 2014.

Job Outlook

Computer Network Architects

Percent change in employment, projected 2014-24

Note: All Occupations includes all occupations in the U.S. Economy.
Source: U.S. Bureau of Labor Statistics, Employment Projections program

Employment of computer network architects is projected to grow 9 percent from 2014 to 2024, faster than the average for all occupations.

Demand for computer network architects will increase as firms continue to expand their information technology (IT) networks. Designing and building these new networks, as well as upgrading existing ones, will create opportunities for computer network architects. The expansion of healthcare information technology will also contribute to employment growth.

Adoption of cloud computing, which allows users to access storage, software, and other computer services over the Internet, is likely to dampen the demand for computer network architects. Organizations will no longer have to design and build networks in-house; instead, firms that provide cloud services will do this. Smaller firms with minimal IT requirements will find it more cost effective to outsource their reliance on IT to cloud service providers. However, because architects at cloud providers can work on more than one organization's network, these providers will not have to employ as many architects as individual organizations do for the same amount of work.

Job Prospects

Applicants with relevant certification should have better prospects for positions where specific hardware or software knowledge and expertise is preferred.

Employment projections data for Computer Network Architects, 2014-24

Occupational Title	SOC Code	Employment, 2014	Projected Employment, 2024	Change, 2014-24		Employment by Industry
				Percent	Numeric	
Computer network architects	15-1143	146,200	158,900	9	12,700	[XLSX]
SOURCE: U.S. Bureau of Labor Statistics, Employment Projections program						

State & Area Data

Occupational Employment Statistics (OES)

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- Computer Network Architects

Projections Central

Occupational employment projections are developed for all states by Labor Market Information (LMI) or individual state Employment Projections offices. All state projections data are available at www.projectionscentral.com. Information on this site allows projected employment growth for an occupation to be com-

pared among states or to be compared within one state. In addition, states may produce projections for areas; there are links to each state's websites where these data may be retrieved.

Career InfoNet

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Similar Occupations

This table shows a list of occupations with job duties that are similar to those of Computer Network Architects.

Occupation	Job Duties	ENTRY-LEVEL EDUCATION	2014 MEDIAN PAY
Computer and Information Research Scientists	Computer and information research scientists invent and design new approaches to computing technology and find innovative uses for existing technology. They study and solve complex problems in computing for business, medicine, science, and other fields.	Doctoral or professional degree	$108,360
Computer and Information Systems Managers	Computer and information systems managers, often called information technology (IT) managers or IT project managers, plan, coordinate, and direct computer-related activities in an organization. They help determine the information technology goals of an organization and are responsible for implementing computer systems to meet those goals.	Bachelor's degree	$127,640
Computer Hardware Engineers	Computer hardware engineers research, design, develop, and test computer systems and components such as processors, circuit boards, memory devices, networks, and routers. These engineers discover new directions in computer hardware, which generate rapid advances in computer technology.	Bachelor's degree	$108,430

Computer Programmers	Computer programmers write and test code that allows computer applications and software programs to function properly. They turn the program designs created by software developers and engineers into instructions that a computer can follow.	Bachelor's degree	$77,550
Computer Support Specialists	Computer support specialists provide help and advice to people and organizations using computer software or equipment. Some, called computer network support specialists, support information technology (IT) employees within their organization. Others, called computer user support specialists, assist non-IT users who are having computer problems.	See How to Become One	$50,380
Computer Systems Analysts	Computer systems analysts study an organization's current computer systems and procedures and design information systems solutions to help the organization operate more efficiently and effectively. They bring business and information technology (IT) together by understanding the needs and limitations of both.	Bachelor's degree	$82,710
Database Administrators	Database administrators (DBAs) use specialized software to store and organize data, such as financial information and customer shipping records. They make sure that data are available to users and are secure from unauthorized access.	Bachelor's degree	$80,280

Information Security Analysts	Information security analysts plan and carry out security measures to protect an organization's computer networks and systems. Their responsibilities are continually expanding as the number of cyberattacks increases.	Bachelor's degree	$88,890
Network and Computer Systems Administrators	Computer networks are critical parts of almost every organization. Network and computer systems administrators are responsible for the day-to-day operation of these networks.	Bachelor's degree	$75,790
Software Developers	Software developers are the creative minds behind computer programs. Some develop the applications that allow people to do specific tasks on a computer or another device. Others develop the underlying systems that run the devices or that control networks.	Bachelor's degree	$97,990

Contacts for More Information

For more information about advertising managers, visit

Association for Computing Machinery

IEEE Computer Society

Computing Research Association

CompTIA

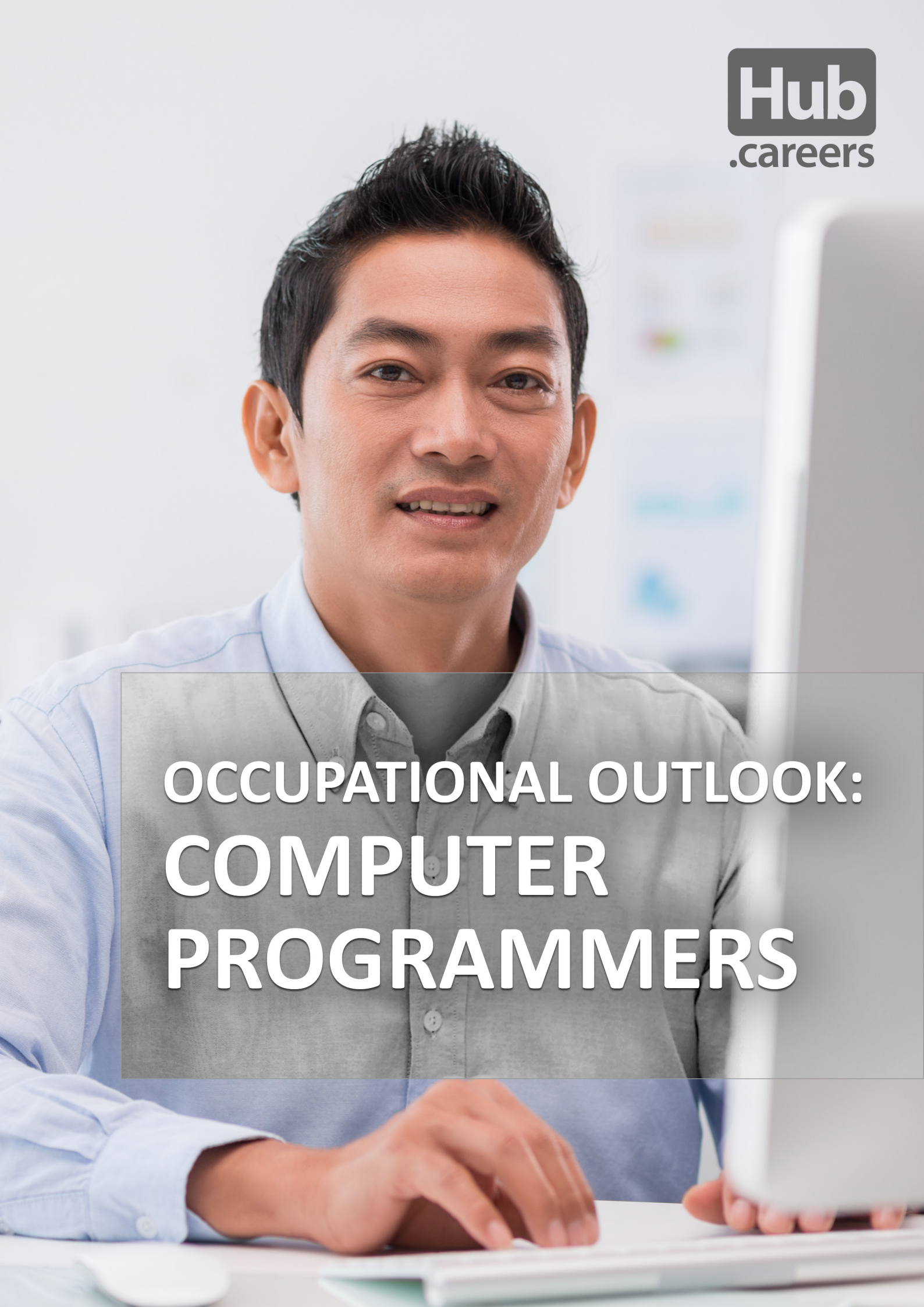
For information about opportunities for women pursuing information technology careers, visit

National Center for Women & Information Technology

O*NET

Computer Network Architects

Telecommunications Engineering Specialists



OCCUPATIONAL OUTLOOK: COMPUTER PROGRAMMERS

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Computer Programmers

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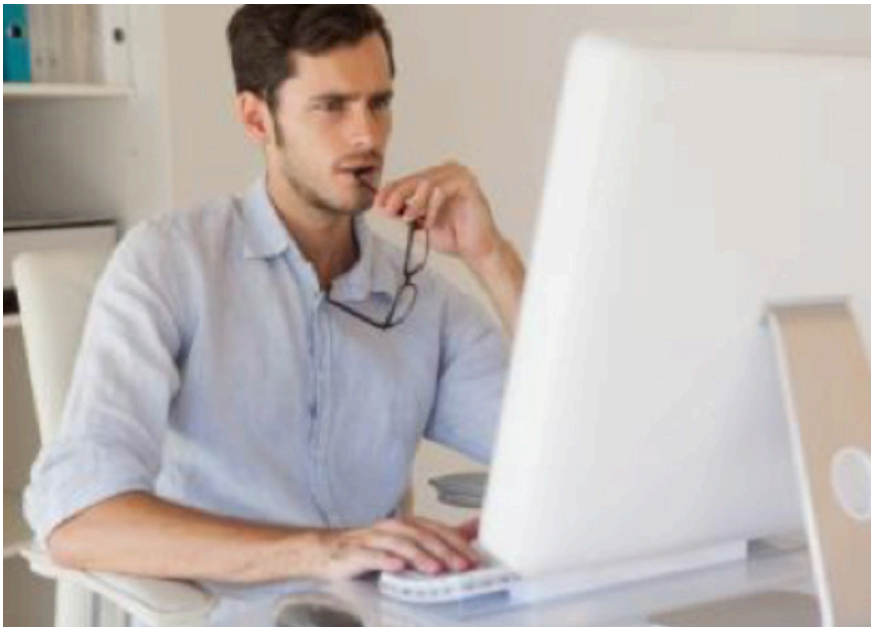
Summary



Programmers spend most of their time writing and testing computer code.

Quick Facts: Computer Programmers	
2014 Median Pay	$77,550 per year $37.28 per hour
Typical Entry-Level Education	Bachelor's degree
Work Experience in a Related Occupation	None
On-the-job Training	None
Number of Jobs, 2014	328,600
Job Outlook, 2014-24	-8% (Decline)
Employment Change, 2014-24	-26,500

What Computer Programmers Do

Computer programmers write and test code that allows computer applications and software programs to function properly. They turn the program designs created by software developers and engineers into instructions that a computer can follow.

Work Environment

Programmers usually work in offices, most commonly in the computer systems design and related services industry.

How to Become a Computer Programmer

Most computer programmers have a bachelor's degree; however, some employers hire workers with an associate's degree. Most programmers specialize in a few programming languages.

Pay

The median annual wage for computer programmers was $77,550 in May 2014.

Job Outlook

Employment of computer programmers is projected to decline 8 percent from 2014 to 2024. Computer programming can be done from anywhere in the world, so companies sometimes hire programmers in countries where wages are lower.

State & Area Data

Compare the job duties, education, job growth, and pay of computer programmers with similar occupations.

Similar Occupations

Learn more about computer programmers by visiting additional resources, including O*NET, a source on key characteristics of workers and occupations.

More Information, Including Links to O*NET

Learn more about Computer Programmers by visiting additional resources, including O*NET, a source on key characteristics of workers and occupations.

What Computer Programmers Do

Computer programmers write programs in a variety of computer languages, such as C++ and Java.

Computer programmers write and test code that allows computer applications and software programs to function properly. They turn the program designs created by software developers and engineers into instructions that a computer can follow. In addition, programmers test newly created applications and programs to ensure that they produce the expected results. If they do not work correctly, computer programmers check the code for mistakes and fix them.

Duties

Computer programmers typically do the following:

- Write programs in a variety of computer languages, such as C++ and Java
- Update and expand existing programs

- Test programs for errors and fix the faulty lines of computer code responsible
- Create and test code in an integrated development environment (IDE)
- Use code libraries, which are collections of independent lines of code, to simplify the writing

Programmers work closely with software developers, and in some businesses their duties overlap. When such overlap occurs, programmers can do work that is typical of developers, such as designing the program. Program design entails planning the software initially, creating models and flowcharts detailing how the code is to be written, writing and debugging code, and designing an application or systems interface. Programmers often use an IDE, which allows them to create, edit, and test code.

A program's purpose determines the complexity of its computer code. For example, a weather application for a mobile device will require less programming than a social-networking application. Simpler programs can be written in less time. Complex programs, such as computer operating systems, can take a year or more to complete.

Software-as-a-service (SaaS), which consists of applications provided through the Internet, is a growing field. Although programmers typically need to rewrite their programs to work on different system platforms, such as Windows or OS X, applications created with SaaS work on all platforms. Accordingly, programmers writing SaaS applications may not have to rewrite as much code as other programmers do and can instead spend more time writing new programs.

Risk analysts evaluate the risk in investment decisions and determine how to manage unpredictability and limit potential losses. This job is carried out by making investment decisions such as selecting dissimilar stocks or having a combination of stocks, bonds, and mutual funds in a portfolio.

Work Environment

Most programmers work independently in offices.

Computer programmers held about 328,600 jobs in 2014. The industries that employed the most computer programmers were as follows:

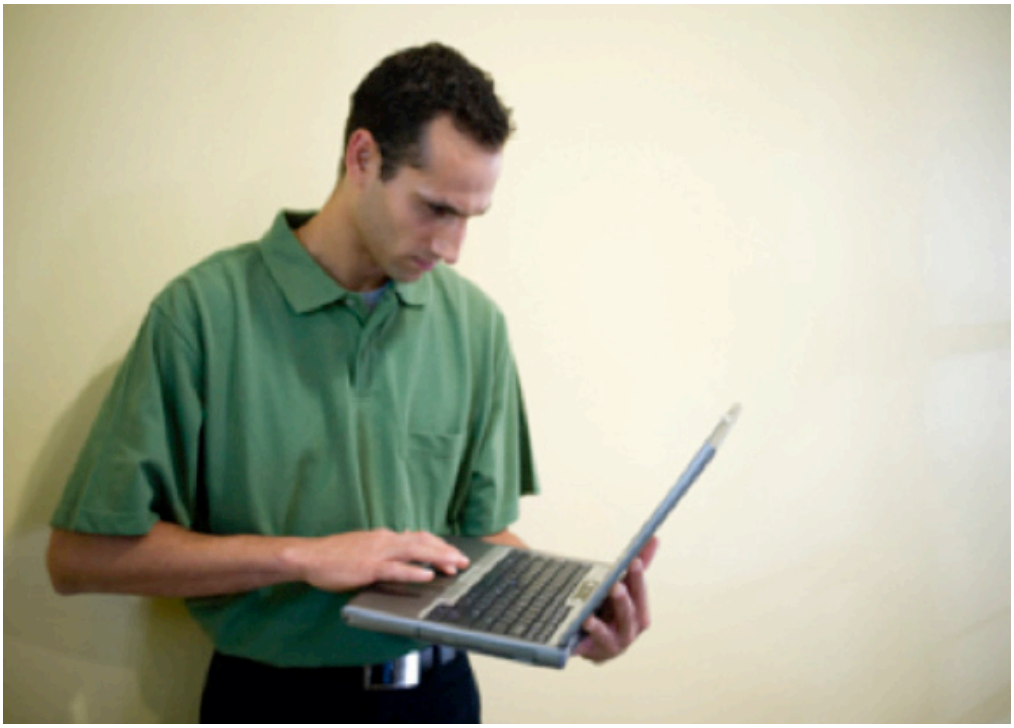
Computer systems design and related services	38%
Software publishers	7
Finance and insurance	7
Manufacturing	5
Administrative and support services	5

Programmers normally work alone, but sometimes work with other computer specialists on large projects. Because writing code can be done anywhere, many programmers telecommute.

Work Schedules

Most computer programmers work full time.

How to Become a Computer Programmer



Most programmers have a degree in computer science or a related field. Most computer programmers have a bachelor's degree in computer science or a related subject; however, some employers hire workers with an associate's degree. Most programmers specialize in a few programming languages.

Education

Most computer programmers have a bachelor's degree; however, some employers hire workers who have an associate's degree. Most programmers get a degree in computer science or a related subject. Programmers who work in specific fields, such as healthcare or accounting, may take classes in that field to supplement their degree in computer programming. In addition, employ-

ers value experience, which many students gain through internships.

Most programmers learn a few computer languages while in school. However, a computer science degree gives students the skills needed to learn new computer languages easily. During their classes, students receive hands-on experience writing code, testing programs, fixing errors, and doing many other tasks that they will perform on the job.

To keep up with changing technology, computer programmers may take continuing education and professional development seminars to learn new programming languages or about upgrades to programming languages they already know.

Licenses, Certifications, and Registrations

Programmers can become certified in specific programming languages or for vendor-specific programming products. Some companies require their computer programmers to be certified in the products they use.

Other Experience

Many students gain experience in computer programming by completing an internship at a software company while in college.

Advancement

Programmers who have general business experience may become computer systems analysts. With experience, some programmers may become software developers. They may also be promoted to managerial positions. For more information, see the profiles on computer systems analysts, software developers, andcomputer and information systems managers.

Important Qualities

Analytical skills. Computer programmers must understand complex instructions in order to create computer code.

Concentration. Programmers must be able to work at a computer, writing lines of code for long periods.

Detail oriented. Computer programmers must closely examine the code they write because a small mistake can affect the entire computer program.

Troubleshooting skills. An important part of a programmer's job is to check the code for errors and fix any they find

Pay

Computer Programmers

Median annual wages, May 2014

Note: All Occupations includes all occupations in the U.S. Economy.
Source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics

The median annual wage for computer programmers was $77,550 in May 2014. The median wage is the wage at which half the workers in an occupation earned more than that amount and half earned less. The lowest 10 percent earned less than $44,140, and the highest 10 percent earned more than $127,640.

In May 2014, the median annual wages for computer programmers in the top industries in which they worked were as follows:

Software publishers	$99,580
Finance and insurance	84,260
Administrative and support services	79,780
Manufacturing	76,910
Computer systems design and related services	76,240

Most computer programmers work full time.

Job Outlook

Computer Programmers

Percent change in employment, projected 2014-24

Note: All Occupations includes all occupations in the U.S. Economy.
Source: U.S. Bureau of Labor Statistics, Employment Projections program

Employment of computer programmers is projected to decline 8 percent from 2014 to 2024. Computer programming can be done from anywhere in the world, so companies sometimes hire programmers in countries where wages are lower. This ongoing trend is projected to limit growth for computer programmers in the United States. However, the high costs associated with managing projects given to overseas programmers sometimes offsets the savings from the lower wages, causing some companies to bring back or keep programming jobs in the United States.

Many computer programmers work in the computer system design and related services industry, which is expected to grow as a result of increasing demand for new computer software. The software publishers industry is also expected to grow as the use of software offered over the Internet increases. This new use of software over the Internet should lower costs for firms and allow users more customization. In addition, new applications will have to be developed for mobile technology and the healthcare industry. An increase in computer systems that are built into electronics and other noncomputer products should result in some job growth for computer programmers and software developers.

Job Prospects

Job prospects will be best for programmers who have a bachelor's degree or higher and knowledge of a variety of programming languages. Keeping up to date with the newest programming tools will also improve job prospects.

Employment projections data for Computer Programmers, 2014-24

Occupational Title	SOC Code	Employment, 2014	Projected Employment, 2024	Change, 2014-24		Employment by Industry
				Percent	Numeric	
SOURCE: U.S. Bureau of Labor Statistics, Employment Projections program						

State & Area Data

Occupational Employment Statistics (OES)

The Occupational Employment Statistics (OES) program produces employment and wage estimates annually for over 800 occupations. These estimates are available for the nation as a whole, for individual states, and for metropolitan and nonmetropolitan areas. The link(s) below go to OES data maps for employment and wages by state and area.

- Computer Programmers

Projections Central

Occupational employment projections are developed for all states by Labor Market Information (LMI) or individual state Employment Projections offices. All state projections data are available at www.projectionscentral.com. Information on this site allows projected employment growth for an occupation to be compared among states or to be compared within one state. In addition, states may

produce projections for areas; there are links to each state's websites where these data may be retrieved.

Career InfoNet

America's Career InfoNet includes hundreds of occupational profiles with data available by state and metro area. There are links in the left-hand side menu to compare occupational employment by state and occupational wages by local area or metro area. There is also a salary info tool to search for wages by zip code.

Similar Occupations

This table shows a list of occupations with job duties that are similar to those of Computer Programmers.

Occupation	Job Duties	ENTRY-LEVEL EDUCATION	2014 MEDIAN PAY
Computer and Information Research Scientists	Computer and information research scientists invent and design new approaches to computing technology and find innovative uses for existing technology. They study and solve complex problems in computing for business, medicine, science, and other fields.	Doctoral or professional degree	$108,360
Computer and Information Systems Managers	Computer and information systems managers, often called information technology (IT) managers or IT project managers, plan, coordinate, and direct computer-related activities in an organization. They help determine the information technology goals of an organization and are responsible for implementing computer systems to meet those goals.	Bachelor's degree	$127,640
Computer Hardware Engineers	Computer hardware engineers research, design, develop, and test computer systems and components such as processors, circuit boards, memory devices, networks, and routers. These engineers discover new directions in computer hardware, which generate rapid advances in computer technology.	Bachelor's degree	$108,430

Computer Network Architects	Computer network architects design and build data communication networks, including local area networks (LANs), wide area networks (WANs), and intranets. These networks range from small connections between two offices to next-generation networking capabilities such as a cloud infrastructure that serves multiple customers.	Bachelor's degree	$98,430
Computer Support Specialists	Computer support specialists provide help and advice to people and organizations using computer software or equipment. Some, called computer network support specialists, support information technology (IT) employees within their organization. Others, called computer user support specialists, assist non-IT users who are having computer problems.	See How to Become One	$50,380
Computer Systems Analysts	Computer systems analysts study an organization's current computer systems and procedures and design information systems solutions to help the organization operate more efficiently and effectively. They bring business and information technology (IT) together by understanding the needs and limitations of both.	Bachelor's degree	$82,710
Database Administrators	Database administrators (DBAs) use specialized software to store and organize data, such as financial information and customer shipping records. They make sure that data are available to users and are secure from unauthorized access.	Bachelor's degree	$80,280

Information Security Analysts	Information security analysts plan and carry out security measures to protect an organization's computer networks and systems. Their responsibilities are continually expanding as the number of cyberattacks increases.	Bachelor's degree	$88,890
Network and Computer Systems Administrators	Computer networks are critical parts of almost every organization. Network and computer systems administrators are responsible for the day-to-day operation of these networks.	Bachelor's degree	$75,790
Software Developers	Software developers are the creative minds behind computer programs. Some develop the applications that allow people to do specific tasks on a computer or another device. Others develop the underlying systems that run the devices or that control networks.	Bachelor's degree	$97,990
Web Developers	Web developers design and create websites. They are responsible for the look of the site. They are also responsible for the site's technical aspects, such as its performance and capacity, which are measures of a website's speed and how much traffic the site can handle. In addition, web developers may create content for the site.	Associate's degree	$63,490

Contacts for More Information

For more information about advertising managers, visit

Association for Computing Machinery

CompTIA

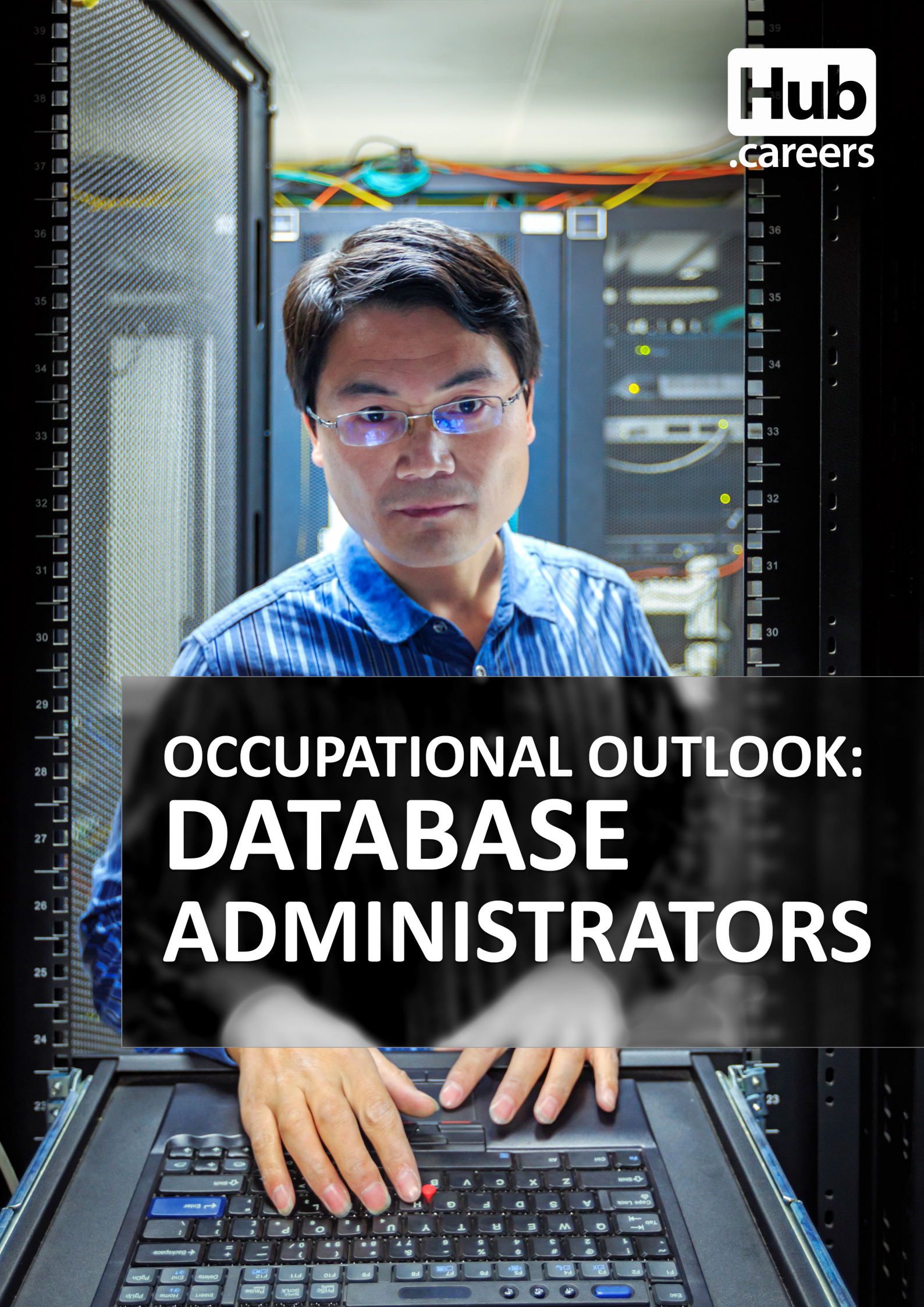
IEEE Computer Society

For information about opportunities for women pursuing information technology careers, visit

National Center for Women & Information Technology

O*NET

Computer Programmers



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OCCUPATIONAL OUTLOOK: DATABASE ADMINISTRATORS

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Database Administrators

Table of Contents

Accountants and Auditors

Summary

Database administrators ensure that data are available to many different users.

Quick Facts: Database Administrators	
2014 Median Pay	$80,280 per year $38.60 per hour
Typical Entry-Level Education	Bachelor's degree
Work Experience in a Related Occupation	Less than 5 years
On-the-job Training	None
Number of Jobs, 2014	120,000
Job Outlook, 2014-24	11% (Faster than average)
Employment Change, 2014-24	13,400

What Database Administrators Do

Database administrators (DBAs) use specialized software to store and organize data, such as financial information and customer shipping records. They make sure that data are available to users and are secure from unauthorized access.

Work Environment

Almost all database administrators work full time. About 1 in 5 worked more than 40 hours per week in 2014.

How to Become a Database Administrator

Database administrators usually have a bachelor's degree in an information- or computer- related subject such as computer science. Before becoming an administrator, these workers typically get work experience in a related field.

Pay

The median annual wage for database administrators was $80,280 in May 2014.

Job Outlook

Employment of database administrators is projected to grow 11 percent from 2014 to 2024, faster than the average for all occupations. Growth in this occupation will be driven by the increased data needs of companies across the economy.

State & Area Data

Explore resources for employment and wages by state and area for database administrators.

Similar Occupations

Compare the job duties, education, job growth, and pay of database administrators with similar occupations.

More Information, Including Links to O*NET

Learn more about database administrators by visiting additional resources, including O*NET, a source on key characteristics of workers and occupations.

What Database Administrators Do

Database administrators ensure databases run efficiently.

Database administrators use specialized software to store and organize data, such as financial information and customer shipping records. They make sure that data are available to users and are secure from unauthorized access.

Duties

Database administrators typically do the following:

- Ensure that organizational data is secure
- Back up and restore data to prevent data loss
- Identify user needs to create and administer databases
- Ensure that the database operates efficiently and without error
- Make and test modifications to the database structure when needed
- Maintain the database and update permissions
- Merge old databases into new ones

Database administrators, often called DBAs, make sure that data analysts can easily use the database to find the information they need and that the system performs as it should. DBAs sometimes work with an organization's management to understand the company's data needs and to plan the goals of the database. They also may work with computer and information systems managers to provide database solutions. Database administrators are responsible for backing up systems to prevent data loss in case of a power outage or other disaster. They also ensure the integrity of the database, guaranteeing that the data stored in it come from reliable sources.

Some DBAs oversee the development of new databases. They have to determine what the needs of the database are and who will be using it. They often monitor database performance and conduct performance-tuning support. Database administrators often plan security measures, making sure that data are secure from unauthorized access. Many databases contain personal or financial information, making security important.

Many database administrators are general-purpose DBAs and have all these duties. However, some DBAs specialize in certain tasks that vary with an organization and its needs. Two common specialties are as follows:

System DBAs are responsible for the physical and technical aspects of a database, such as installing upgrades and patches to fix program bugs. They typically have a background in system architecture and ensure that the firm's database management systems work properly.

Application DBAs support a database that has been designed for a specific application or a set of applications, such as customer-service software. Using complex programming languages, they may write or debug programs and must be able to manage the applications that work with the database. They also do all the tasks of a general DBA, but only for their particular application.

Work Environment

Database administrators are often referred to as DBAs.

Database administrators held about 120,000 jobs in 2014. The industries that employed the most database administrators were as follows:

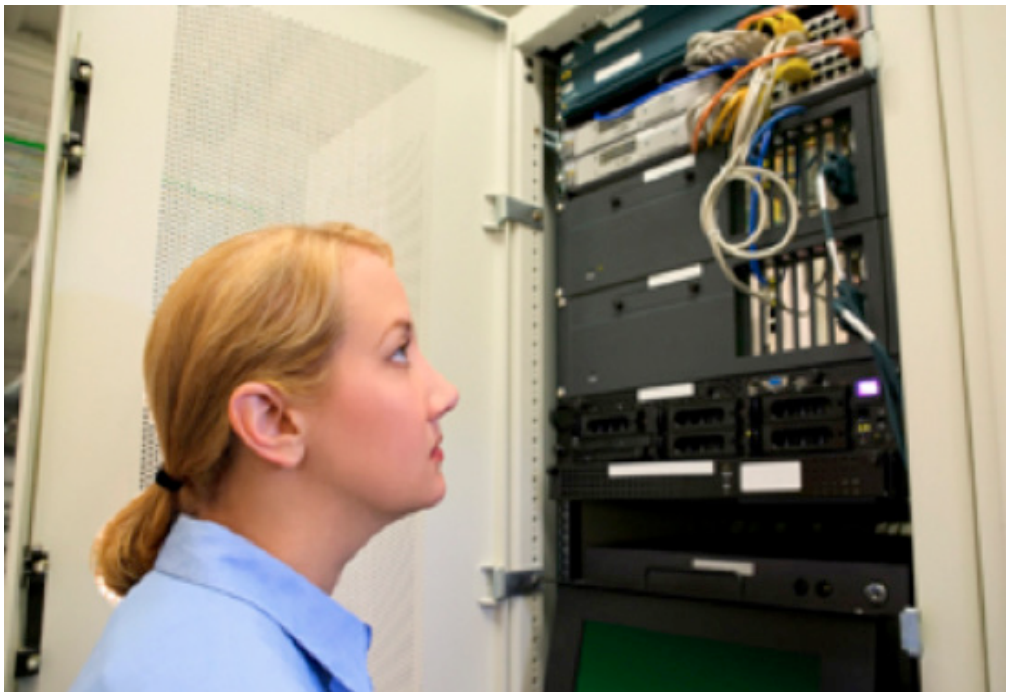
Computer systems design and related services	15%
Information	12
Educational services; state, local, and private	11
Management of companies and enterprises	7
Insurance carriers and related activities	7

The largest number work for firms in the computer systems design and related services industry, such as data hosting and data processing firms. Other DBAs are employed by firms with large databases, such as insurance companies and banks, both of which keep track of vast amounts of personal and financial data for their clients. Some DBAs administer databases for retail companies that keep track of their buyers' credit card and shipping information; others work for healthcare firms and manage patients' medical records.

Work Schedules

Almost all database administrators work full time. About 1 in 5 worked more than 40 hours per week in 2014.

How to Become a Database Administrator



Most database administrators have a bachelor's degree in management information systems (MIS) or a computer-related field.

Database administrators (DBAs) usually have a bachelor's degree in an information- or computer-related subject such as computer science. Before becoming an administrator, these workers typically get work experience in a related field.

Education

Most database administrators have a bachelor's degree in management information systems (MIS) or a computer-related field. Firms with large databases may prefer applicants who have a master's degree focusing on data or database management, typically either in computer science, information systems, or information technology.

Database administrators need an understanding of database languages, the

most common of which is Structured Query Language, commonly called SQL. Most database systems use some variation of SQL, and a DBA will need to become familiar with whichever programming language the firm uses.

Licenses, Certifications, and Registrations

Certification is generally offered directly from software vendors or from vendor-neutral certification providers. Certification validates the knowledge and best practices required from DBAs. Companies may require their database administrators to be certified in the products they use.

Work Experience in a Related Occupation

Most do not begin their careers as database administrators. Many first work as database developers or data analysts. A database developer is a type of software developer who specializes in creating databases. The job of a data analyst is to interpret the information stored in a database in a way the firm can use. Depending on their specialty, data analysts can have different job titles, including financial analyst, market research analyst, and operations research analyst. After mastering one of these fields, they may become a database administrator. For more information, see the profiles on software developers, financial analysts,market research analysts, and operations research analysts.

Advancement

Database administrators can advance to become computer and information systems managers.

Important Qualities

Analytical skills. DBAs must be able to monitor a database system's performance to determine when action is needed. They must be able to evaluate complex information that comes from a variety of sources.

Communication skills. Most database administrators work on teams and must be able to communicate effectively with developers, managers, and other workers.

Detail oriented. Working with databases requires an understanding of complex systems, in which a minor error can cause major problems. For example, mixing up customers' credit card information can cause someone to be charged for a purchase he or she didn't make.

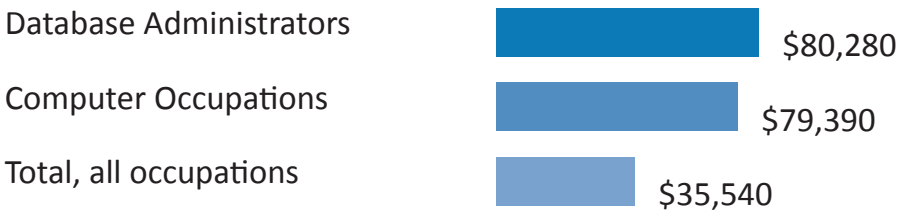
Logical thinking. Database administrators must make sense of data and organize it in a meaningful pattern so that it is easily retrievable.

Problem-solving skills. When problems with a database arise, administrators must be able to troubleshoot and correct the problems.

Pay

Database Administrators

Median annual wages, May 2014



Note: All Occupations includes all occupations in the U.S. Economy.
Source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics

The median annual wage for database administrators was $80,280 in May 2014. The median wage is the wage at which half the workers in an occupation earned

more than that amount and half earned less. The lowest 10 percent earned less than $44,470, and the highest 10 percent earned more than $123,780.

In May 2014, the median annual wages for database administrators in the top industries in which they worked were as follows:

Computer systems design and related services	$89,200
Management of companies and enterprises	87.910
Insurance carriers and related activities	85,200
Information	84.570
Educational services; state, local, and private	64,940

Almost all database administrators work full time. About 1 in 5 worked more than 40 hours per week in 2014.

Job Outlook

Database Administrators

Percent change in employment, projected 2014-24

Note: All Occupations includes all occupations in the U.S. Economy.
Source: U.S. Bureau of Labor Statistics, Employment Projections program

Employment of database administrators (DBAs) is projected to grow 11 percent from 2014 to 2024, faster than the average for all occupations. Growth in this occupation will be driven by the increased data needs of companies in all sectors of the economy. Database administrators will be needed to organize and present data in a way that makes it easy for analysts and other stakeholders to understand. The increasing popularity of database-as-a-service, which allows database administration to be done by a third party over the Internet, could increase the employment of DBAs at cloud computing firms in the data processing, hosting, and related services industry. Employment of DBAs is projected to grow 26 percent in this industry from 2014 to 2024.

Employment of DBAs is projected to grow 26 percent in computer systems design and related services from 2014 to 2024. The increasing adoption of cloud services by small and medium-sized businesses that do not have their own dedicated information technology (IT) departments could increase the employment of DBAs in establishments in this industry.

Employment of DBAs is projected to grow 7 percent in general medical and surgical hospitals from 2014 to 2024. As the use of electronic medical records increases, more databases will be needed to keep track of patient information.

Job Prospects

Job prospects should be favorable. Database administrators are in high demand, and firms sometimes have difficulty finding qualified workers. Applicants who have experience with the latest technology should have the best prospects.

Employment projections data for Database Administrators, 2014-24

				Change, 2014-24		
Occupational Title	SOC Code	Employment, 2014	Projected Employment, 2024	Percent	Numeric	Employment by Industry
Accountants and auditors	15-1141	120,000	133,400	11	13,400	[XLSX]
SOURCE: U.S. Bureau of Labor Statistics, Employment Projections program						

State & Area Data

Occupational Employment Statistics (OES)

The Occupational Employment Statistics (OES) program produces employment and wage estimates annually for over 800 occupations. These estimates are available for the nation as a whole, for individual states, and for metropolitan and nonmetropolitan areas. The link(s) below go to OES data maps for employment and wages by state and area.

- Database Administrators

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Similar Occupations

This table shows a list of occupations with job duties that are similar to those of accountants and auditors.

Occupation	Job Duties	ENTRY-LEVEL EDUCATION	2014 MEDIAN PAY
Computer and Information Systems Managers	Computer systems analysts study an organization's current computer systems and procedures and design information systems solutions to help the organization operate more efficiently and effectively. They bring business and information technology (IT) together by understanding the needs and limitations of both.	Bachelor's degree	$127,640
Computer Network Architects	Financial analysts provide guidance to businesses and individuals making investment decisions. They assess the performance of stocks, bonds, and other types of investments.	Bachelor's degree	$98,430
Computer Programmers	Information security analysts plan and carry out security measures to protect an organization's computer networks and systems. Their responsibilities are continually expanding as the number of cyberattacks increases.	Bachelor's degree	$77,550
Computer Support Specialists	Market research analysts study market conditions to examine potential sales of a product or service. They help companies understand what products people want, who will buy them, and at what price.	See How to Become One	$50,380

Computer Systems Analysts	Computer networks are critical parts of almost every organization. Network and computer systems administrators are responsible for the day-to-day operation of these networks.	Bachelor's degree	$82,710
Financial Analysts	Operations research analysts use advanced mathematical and analytical methods to help organizations investigate complex issues, identify and solve problems, and make better decisions.	Bachelor's degree	$78,620
Information Security Analysts	Software developers are the creative minds behind computer programs. Some develop the applications that allow people to do specific tasks on a computer or another device. Others develop the underlying systems that run the devices or that control networks.	Bachelor's degree	$88,890
Market Research Analysts	Web developers design and create websites. They are responsible for the look of the site. They are also responsible for the site's technical aspects, such as its performance and capacity, which are measures of a website's speed and how much traffic the site can handle. In addition, web developers may create content for the site.	Bachelor's degree	$61,290
Network and Computer Systems Administrators	Tax examiners and collectors, and revenue agents ensure that federal, state, and local governments get their tax money from businesses and citizens. They review tax returns, conduct audits, identify taxes owed, and collect overdue tax payments.	Bachelor's degree	$75,790

Operations Research Analysts	Top executives devise strategies and policies to ensure that an organization meets its goals. They plan, direct, and coordinate operational activities of companies and organizations.	Bachelor's degree	$76,660
Software Developers	Bachelor's degree	Bachelor's degree	$97,990
Web Developers		Associate's degree	$63,490

Contacts for More Information

For more information about database administrators, visit

Association for Computing Machinery

IEEE Computer Society

Computing Research Association

For more information about opportunities for women pursuing information technology careers, visit

National Center for Women & Information Technology

O*NET

Database Administrators

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OCCUPATIONAL OUTLOOK: INFORMATION SECURITY ANALYSTS

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Information Security Analysts

Table of Contents

Information Security Analysts

Summary

Information security analysts work to protect a company's computer systems.

Quick Facts: Information Security Analysts	
2014 Median Pay	$88,890 per year $42.74 per hour
Typical Entry-Level Education	Bachelor's degree
Work Experience in a Related Occupation	Less than 5 years
On-the-job Training	None
Number of Jobs, 2014	82,900
Job Outlook, 2014-24	18% (Much faster than average)
Employment Change, 2014-24	14,800

What Information Security Analysts Do

Information security analysts plan and carry out security measures to protect an organization's computer networks and systems. Their responsibilities are continually expanding as the number of cyberattacks increases.

Work Environment

Most information security analysts work for computer companies, consulting firms, or business and financial companies.

How to Become an Information Security Analyst

Most information security analyst positions require a bachelor's degree in a computer-related field. Employers usually prefer to hire analysts with experience in a related occupation.

Pay

The median annual wage for information security analysts was $88,890 in May 2014.

Job Outlook

Employment of information security analysts is projected to grow 18 percent from 2014 to 2024, much faster than the average for all occupations. Demand for information security analysts is expected to be very high, as these analysts will be needed to create innovative solutions to prevent hackers from stealing critical information or causing problems for computer networks.

State & Area Data

Explore resources for employment and wages by state and area for information security analysts.

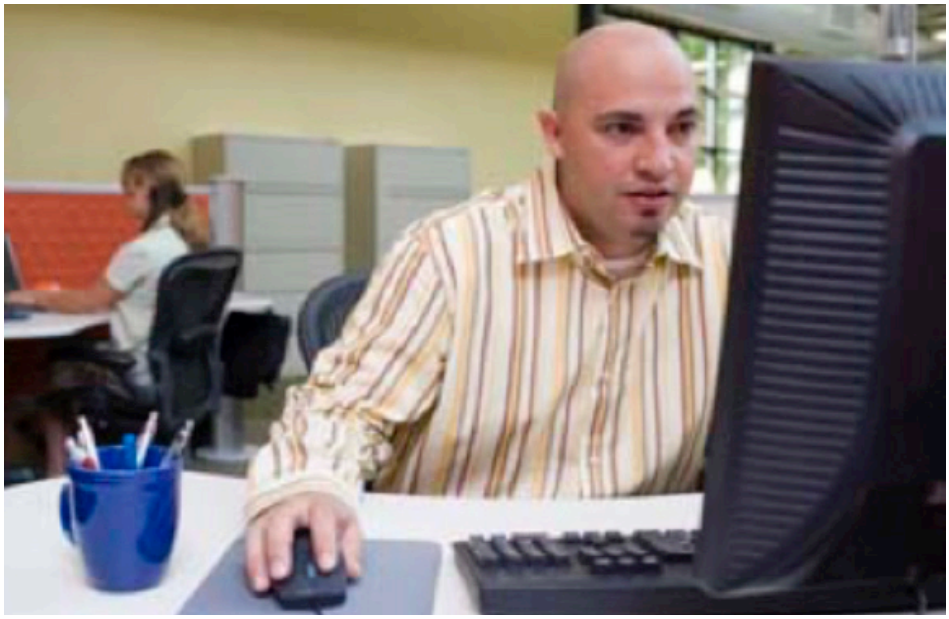
Similar Occupations

Compare the job duties, education, job growth, and pay of information security analysts with similar occupations.

More Information, Including Links to O*NET

Learn more about information security analysts by visiting additional resources, including O*NET, a source on key characteristics of workers and occupations.

What Information Security Analysts Do



Information security analysts install software, such as firewalls, to protect computer networks.

Information security analysts plan and carry out security measures to protect an organization's computer networks and systems. Their responsibilities are continually expanding as the number of cyberattacks increases.

Duties

Information security analysts typically do the following:

- Monitor their organization's networks for security breaches and investigate a violation when one occurs
- Install and use software, such as firewalls and data encryption programs, to protect sensitive information
- Prepare reports that document security breaches and the extent of the damage caused by the breaches
- Conduct penetration testing, which is when analysts simulate attacks to look for vulnerabilities in their systems before they can be exploited

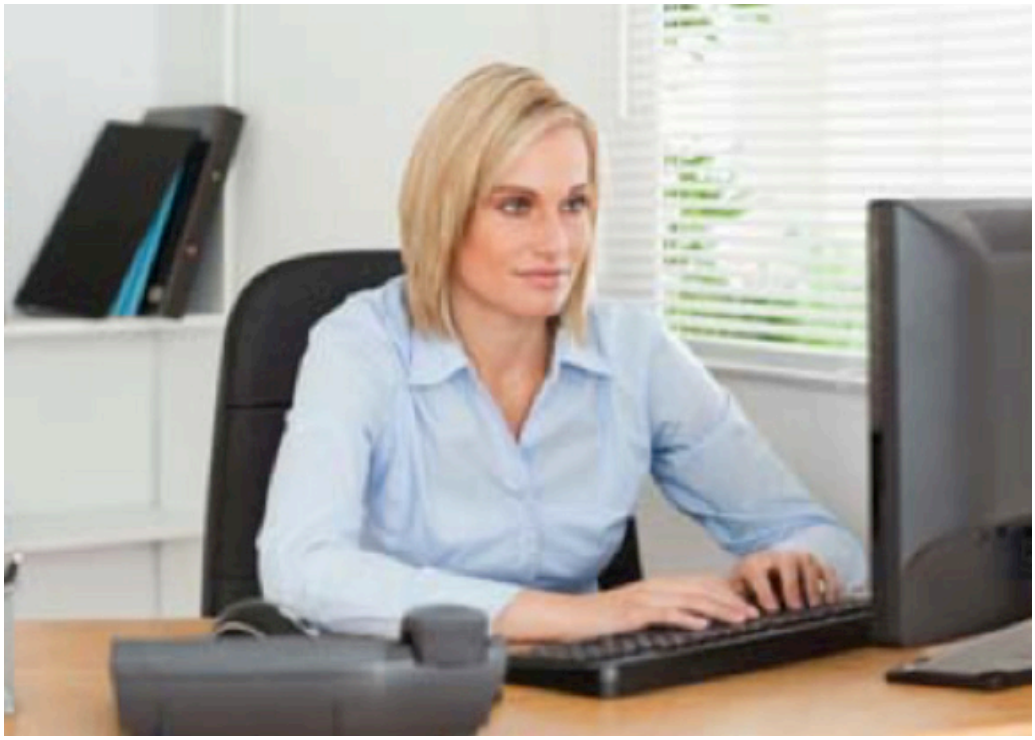
- Research the latest information technology (IT) security trends
- Help plan and carry out an organization's way of handling security
- Develop security standards and best practices for their organization
- Recommend security enhancements to management or senior IT staff
- Help computer users when they need to install or learn about new security products and procedures

Information security analysts must continually adapt to stay a step ahead of cyberattackers. They must stay up to date on the latest methods attackers are using to infiltrate computer systems and on IT security. Analysts need to research new security technology to decide what will most effectively protect their organization. This may involve attending cybersecurity conferences to hear firsthand accounts of other professionals who have experienced new types of attacks.

IT security analysts are heavily involved with creating their organization's disaster recovery plan, a procedure that IT employees follow in case of emergency. These plans allow for the continued operation of an organization's IT department. It includes preventive measures such as regularly copying and transferring data to an offsite location. It also involves plans to restore proper IT functioning after a disaster. Analysts continually test the steps in their recovery plans.

Because information security is important, these workers usually report directly to upper management. Many information security analysts work with an organization's computer and information systems manager or chief technology officer (CTO) to design security or disaster recovery systems.

Work Environment



Many analysts work in IT departments and manage the security of their companies computer networks.

Information security analysts held about 82,900 jobs in 2014. The industries that employed the most information security analysts were as follows:

Computer systems design and related services	26%
Information	10
Management of companies and enterprises	8
Depository credit intermediation	7
Management, scientific, and technical consulting services	5

Many information security analysts work with other members of an information technology department, such as network administrators or computer systems analysts.

Work Schedules

Most information security analysts work full time. Information security analysts sometimes have to be on call outside of normal business hours in case of an emergency at their organization. About 1 in 4 worked more than 40 hours per week in 2014.

How to Become an Information Security Analyst

Information security is a new field and many schools are still developing programs to teach the subject.

Most information security analyst positions require a bachelor's degree in a computer-related field. Employers usually prefer analysts to have experience in a related occupation.

Education

Information security analysts usually need at least a bachelor's degree in computer science, programming, or a related field. As information security continues to develop as a career field, many schools are responding with information security programs for prospective job seekers. These programs may become a common path for entry into the occupation. Currently, a well-rounded computer education is preferred.

Employers of information security analysts sometimes prefer applicants who have a Master's of Business Administration (MBA) in information systems. Programs offering the MBA in information systems generally require 2 years of study beyond the undergraduate level and include both business and computer-related courses.

Work Experience in a Related Occupation

Information security analysts generally need to have previous experience in a related occupation. Many analysts have experience in an information technology department, often as a network or systems administrator. Some employers look for people who have already worked in fields related to the one in which they are hiring. For example, if the job opening is in database security, they may look for a database administrator. If they are hiring in systems security, a computer systems analyst may be an ideal candidate.

Licenses, Certifications, and Registrations

There are a number of information security certifications available, and many employers prefer job candidates to have one. Certification validates the knowledge and best practices required from information security analysts. Some are general information security certificates, such as the Certified Information Systems Security Professional, and others have a narrow focus, such as penetration testing or systems auditing.

Advancement

Information security analysts can advance to become chief security officers or another type of computer and information systems manager.

Important Qualities

Analytical skills. Information security analysts must carefully study computer systems and networks and assess risks to determine how security policies and protocols can be improved.

Detail oriented. Because cyberattacks can be difficult to detect, information security analysts pay careful attention to their computer systems and watch for minor changes in performance.

Ingenuity. Information security analysts anticipate information security risks and implement new ways to protect their organizations' computer systems and networks.

Problem-solving skills. Information security analysts respond to security alerts and uncover and fix flaws in computer systems and networks.

Pay

Information Security Analysts

Median annual wages, May 2014

Note: All Occupations includes all occupations in the U.S. Economy.
Source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics

The median annual wage for information security analysts was $88,890 in May 2014. The median wage is the wage at which half the workers in an occupation earned more than that amount and half earned less. The lowest 10 percent earned less than $50,300, and the highest 10 percent earned more than $140,460.

In May 2014, the median annual wages for information security analysts in the top industries in which they worked were as follows:

Management, scientific, and technical consulting services	$95,530
Information	94,000
Depository credit intermediation	92,930
Computer systems design and related services	88,680
Management of companies and enterprises	85,720

Most information security analysts work full time. Information security analysts sometimes have to be on call outside of normal business hours in case of an emergency at their organization. About 1 in 4 worked more than 40 hours per week in 2014.

Job Outlook

Information Security Analysts

Percent change in employment, projected 2014-24

Note: All Occupations includes all occupations in the U.S. Economy.
Source: U.S. Bureau of Labor Statistics, Employment Projections program

Employment of information security analysts is projected to grow 18 percent from 2014 to 2024, much faster than the average for all occupations.

Demand for information security analysts is expected to be very high. Cyberattacks have grown in frequency, and analysts will be needed to come up with innovative solutions to prevent hackers from stealing critical information or creating problems for computer networks.

The federal government is expected to greatly increase its use of information security analysts to protect the nation's critical information technology (IT) systems. In addition, as the healthcare industry expands its use of electronic medical records, ensuring patients' privacy and protecting personal data are becoming more important. More information security analysts are likely to be needed to create the safeguards that will satisfy patients' concerns.

Employment of information security analysts is projected to grow 36 percent in computer systems design and related services from 2014 to 2024. The increasing adoption of cloud services by small- and medium-sized businesses that do not have their own dedicated IT departments could increase the employment of information security analysts in those establishments.

Job Prospects

Job prospects for information security analysts should be good. Information security analysts with related work experience will have the best prospects. For example, an applicant with experience as a database administrator would have better prospects in database security than someone without that experience.

Employment projections data for Information Security Analysts, 2014-24

Occupational Title	SOC Code	Employment, 2014	Projected Employment, 2024	Change, 2014-24		Employment by Industry
				Percent	Numeric	
Information security analysts	15-1122	82,900	97,700	18	14,800	[XLSX]
SOURCE: U.S. Bureau of Labor Statistics, Employment Projections program						

State & Area Data

Occupational Employment Statistics (OES)

The Occupational Employment Statistics (OES) program produces employment and wage estimates annually for over 800 occupations. These estimates are available for the nation as a whole, for individual states, and for metropolitan and nonmetropolitan areas. The link(s) below go to OES data maps for employment and wages by state and area.

- Information Security Analysts

Projections Central

Occupational employment projections are developed for all states by Labor Market Information (LMI) or individual state Employment Projections offices. All state projections data are available at www.projectionscentral.com. Information on this site allows projected employment growth for an occupation to be compared among states or to be compared within one state. In addition, states may produce projections for areas; there are links to each state's websites where these data may be retrieved.

Career InfoNet

America's Career InfoNet includes hundreds of occupational profiles with data available by state and metro area. There are links in the left-hand side menu to compare occupational employment by state and occupational wages by local area or metro area. There is also a salary info tool to search for wages by zip code.

Similar Occupations

This table shows a list of occupations with job duties that are similar to those of Information Security Analysts.

Occupation	Job Duties	ENTRY-LEVEL EDUCATION	2014 MEDIAN PAY
Computer and Information Research Scientists	Computer and information research scientists invent and design new approaches to computing technology and find innovative uses for existing technology. They study and solve complex problems in computing for business, medicine, science, and other fields.	Doctoral or professional degree	$108,360
Computer and Information Systems Managers	Computer and information systems managers, often called information technology (IT) managers or IT project managers, plan, coordinate, and direct computer-related activities in an organization. They help determine the information technology goals of an organization and are responsible for implementing computer systems to meet those goals.	Bachelor's degree	$127,640
Computer Network Architects	Computer network architects design and build data communication networks, including local area networks (LANs), wide area networks (WANs), and intranets. These networks range from small connections between two offices to next-generation networking capabilities such as a cloud infrastructure that serves multiple customers.	Bachelor's degree	$98,430

Computer Programmers	Computer programmers write and test code that allows computer applications and software programs to function properly. They turn the program designs created by software developers and engineers into instructions that a computer can follow.	Bachelor's degree	$77,550
Computer Support Specialists	Computer support specialists provide help and advice to people and organizations using computer software or equipment. Some, called computer network support specialists, support information technology (IT) employees within their organization. Others, called computer user support specialists, assist non-IT users who are having computer problems.	See How to Become One	$50,380
Computer Systems Analysts	Computer systems analysts study an organization's current computer systems and procedures and design information systems solutions to help the organization operate more efficiently and effectively. They bring business and information technology (IT) together by understanding the needs and limitations of both.	Bachelor's degree	$82,710
Database Administrators	Database administrators (DBAs) use specialized software to store and organize data, such as financial information and customer shipping records. They make sure that data are available to users and are secure from unauthorized access.	Bachelor's degree	$80,280

Information Security Analysts	Information security analysts plan and carry out security measures to protect an organization's computer networks and systems. Their responsibilities are continually expanding as the number of cyberattacks increases.	Bachelor's degree	$88,890
Network and Computer Systems Administrators	Computer networks are critical parts of almost every organization. Network and computer systems administrators are responsible for the day-to-day operation of these networks.	Bachelor's degree	$75,790
Software Developers	Software developers are the creative minds behind computer programs. Some develop the applications that allow people to do specific tasks on a computer or another device. Others develop the underlying systems that run the devices or that control networks.	Bachelor's degree	$97,990
Web Developers	Web developers design and create websites. They are responsible for the look of the site. They are also responsible for the site's technical aspects, such as its performance and capacity, which are measures of a website's speed and how much traffic the site can handle. In addition, web developers may create content for the site.	Associate's degree	$63,490
Web Developers	Web developers design and create websites. They are responsible for the look of the site. They are also responsible for the site's technical aspects, such as its performance and capacity, which are measures of a website's speed and how much traffic the site can handle. In addition, web developers may create content for the site.	Associate's degree	$63,490

Contacts for More Information

For more information about advertising managers, visit

Association for Computing Machinery

IEEE Computer Society

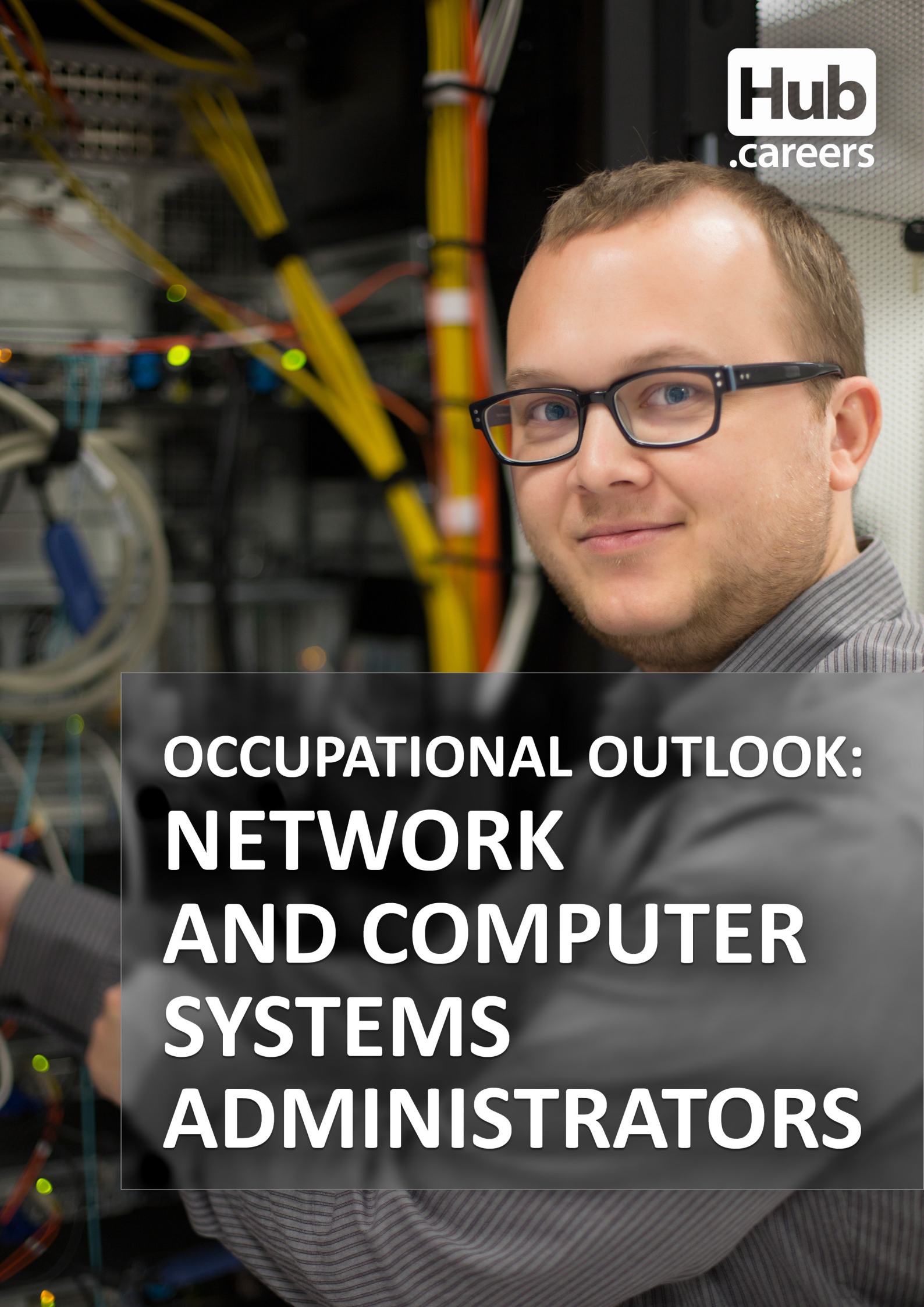
Computing Research Association

For information about opportunities for women pursuing information technology careers, visit

National Center for Women & Information Technology

O*NET

Information Security Analysts



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OCCUPATIONAL OUTLOOK: NETWORK AND COMPUTER SYSTEMS ADMINISTRATORS

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Network and Computer Systems Administrators

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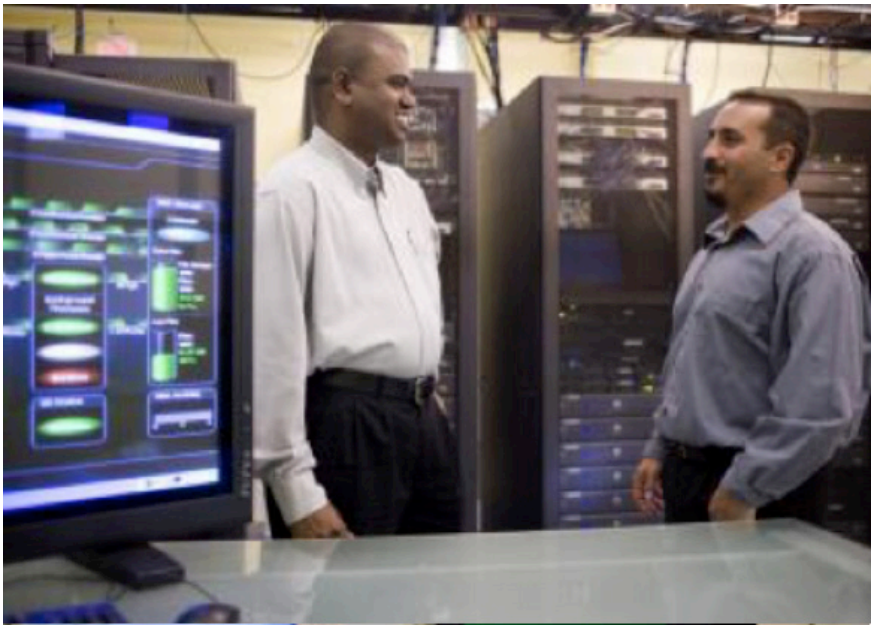
Accountants and Auditors

Summary



Administrators maintain network LANs, WANs, and intranets.

Quick Facts: Network and Computer Systems Administrators	
2014 Median Pay	$75,790 per year $36.44 per hour
Typical Entry-Level Education	Bachelor's degree
Work Experience in a Related Occupation	None
On-the-job Training	None
Number of Jobs, 2014	382,600
Job Outlook, 2014-24	8% (As fast as average)
Employment Change, 2014-24	30,200

What Network and Computer Systems Administrators Do

Computer networks are critical parts of almost every organization. Network and computer systems administrators are responsible for the day-to-day operation of these networks

Work Environment

Network and computer systems administrators work with the physical computer networks of a variety of organizations and therefore are employed in many industries.

How to Become a Database Administrator

Most employers require network and computer systems administrators to have a bachelor's degree in a field related to computer or information science. Others may require only a postsecondary certificate.

Pay

The median annual wage for network and computer systems administrators was $75,790 in May 2014.

Job Outlook

Employment of network and computer systems administrators is projected to grow 8 percent from 2014 to 2024, about as fast as the average for all occupations. Demand for information technology workers is high and should continue to grow as firms invest in newer, faster technology and mobile networks.

State & Area Data

Explore resources for employment and wages by state and area for Network and Computer Systems Administrators.

Similar Occupations

Explore resources for employment and wages by state and area for network and computer systems administrators.

More Information, Including Links to O*NET

Learn more about network and computer systems administrators by visiting additional resources, including O*NET, a source on key characteristics of workers and occupations.

What Network and Computer Systems Administrators Do

Administrators fix computer server problems.

Computer networks are critical parts of almost every organization. Network and computer systems administrators are responsible for the day-to-day operation of these networks. They organize, install, and support an organization's computer systems, including local area networks (LANs), wide area networks (WANs), network segments, intranets, and other data communication systems.

Duties

Network and Computer Systems Administrators typically do the following:

- Determine an organization's network and computer system needs before setting one up
- Install all network hardware and software and make needed upgrades and repairs
- Maintain network and computer system security and ensure that all systems are operating correctly
- Collect data in order to evaluate and optimize network or system performance
- Add users to a network and assign and update security permissions on the network
- Train users in the proper use of hardware and software
- Interpret and solve problems when a user or an automated monitoring system alerts them that one exists

Administrators manage an organization's servers and desktop and mobile equipment. They ensure that email and data storage networks work properly. They also make sure that employees' workstations are working efficiently and stay connected to the central computer network. Some administrators manage telecommunication networks.

In some cases, administrators help network architects design and analyze network models. They also participate in decisions about buying future hardware or software to upgrade their organization's network. Some administrators provide technical support to computer users, and they also may supervise computer support specialists who help solve users' problems.

Work Environment

Network and computer systems administrators work with network architects, IT management, and non-IT staff.

Network and computer systems administrators held about 382,600 jobs in 2014. The industries that employed the most network and computer systems administrators were as follows:

Computer systems design and related services	16%
Information	11
Educational services; state, local, and private	10
Finance and insurance	8
Administrative and support services	7

Network and computer systems administrators work with many types of workers, including information technology (IT) workers, such as computer network architects and computer and information systems managers, and non-IT staff.

Work Schedules

In 2014, most network and computer systems administrators worked full time. Most organizations depend on their computer networks, so many administrators must work overtime to ensure that the networks are operating properly. About 1 in 4 of these administrators worked more than 40 hours per week in 2014.

How to Become a Network and Computer Systems Administrator

Administrators need strong computer skills.

Most employers require network and computer systems administrators to have a bachelor's degree in a field related to computer or information science. Others may require only a postsecondary certificate.

Education

Although some employers require only a postsecondary certificate, most require a bachelor's degree in a field related to computer or information science. There are degree programs that focus on computer network and system administration. However, because administrators work with computer hardware and equipment, a degree in computer engineering or electrical engineering usually is acceptable as well. Programs in these fields usually include classes in computer programming, networking, or systems design.

Because network technology is continually changing, administrators need to keep up with the latest developments. Many continue to take courses throughout their careers and attend information technology (IT) conferences to keep up with the latest technology. Some businesses require that an administrator get a master's degree.

Licenses, Certifications, and Registrations

Certification programs are generally offered directly from vendors or from vendor-neutral certification providers. Certification validates knowledge and best practices required from network and computer systems administrators. Companies may require their network and computer systems administrators to be certified in the product they use. Microsoft and Cisco offer some of the most common certifications.

Other Experience

To gain practical experience, many network administrators participate in internship programs while in school.

Advancement

Network administrators can advance to become computer network architects. They can also advance to managerial jobs in information technology (IT) departments, such as computer and information systems managers.

Important Qualities

Analytical skills. Administrators need analytical skills to evaluate network and system performance and determine how changes in the environment will affect them.

Communication skills. Administrators must be able to describe problems and their solutions to non-IT workers.

Computer skills. Administrators oversee the connections of many different types of computer equipment and must ensure that they all work together properly.

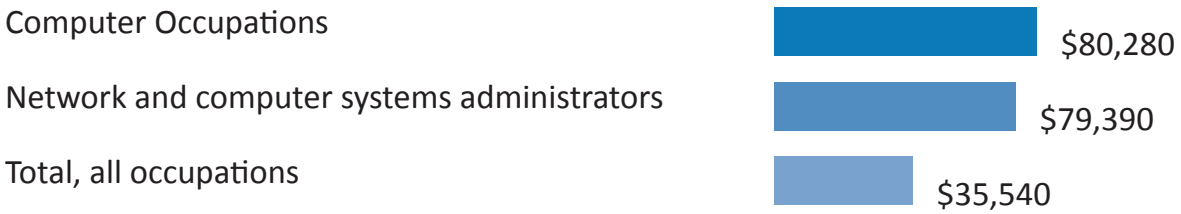
Multitasking skills. Administrators may have to work on many problems and tasks at the same time.

Problem-solving skills. Administrators must be able to quickly resolve any problems that arise with computer networks.

Pay

Network and Computer Systems Administrators

Median annual wages, May 2014



Note: All Occupations includes all occupations in the U.S. Economy.
Source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics

The median annual wage for network and computer systems administrators was $75,790 in May 2014. The median wage is the wage at which half the workers in an occupation earned more than that amount and half earned less. The lowest 10 percent earned less than $46,220, and the highest 10 percent earned more than $120,000.

In May 2014, the median annual wages for network and computer systems administrators in the top industries in which they worked were as follows:

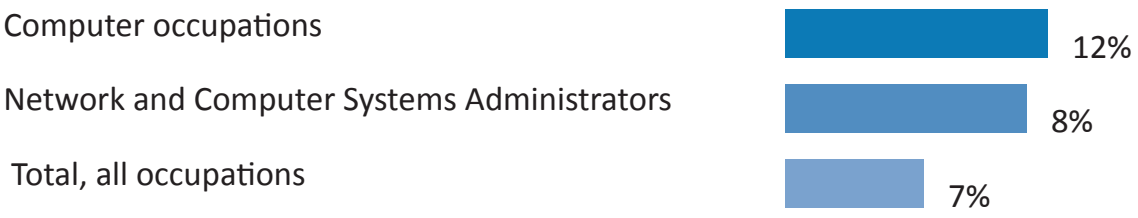
Information	$81,160
Computer systems design and related services	80,080
Finance and insurance	79,710
Administrative and support services	75,860
Educational services; state, local, and private	64,840

In 2014, most network and computer systems administrators worked full time. Most organizations depend on their computer networks, so many administrators work overtime to ensure that the networks are operating properly. About 1 in 4 of these administrators worked more than 40 hours per week in 2014.

Job Outlook

Network and Computer Systems Administrators

Percent change in employment, projected 2014-24



Note: All Occupations includes all occupations in the U.S. Economy.
Source: U.S. Bureau of Labor Statistics, Employment Projections program

Employment of network and computer systems administrators is projected to grow 8 percent from 2014 to 2024, about as fast as the average for all occupations. Demand for information technology workers is high and should continue

to grow as firms invest in newer, faster technology and mobile networks. Growth is also expected in healthcare industries as their use of information technology increases. More administrators will be required to manage the growing systems and networks found at hospitals and other healthcare institutions. However, an increase in cloud computing could raise the productivity of network administrators, slowing their growth across many industries.

Employment of network administrators in the computer systems design and related services industry is projected to grow 31 percent from 2014 to 2024. The increasing adoption of cloud services by small and medium-sized businesses who do not have their own dedicated information technology (IT) departments could increase the demand for network and computer systems administrators in establishments within this industry.

Job Prospects

Job opportunities should be favorable in this occupation. Prospects should be best for applicants who have a bachelor's degree in computer network and system administration or computer science and who are up to date on the latest technology, especially cloud computing.

Employment projections data for network and computer systems administrators, 2014-24

				Change, 2014-24		
Occupational Title	SOC Code	Employment, 2014	Projected Employment, 2024	Percent	Numeric	Employment by Industry
Network and computer systems administrators	15-1142	382,600	412,800	8	30,200	[XLSX]
SOURCE: U.S. Bureau of Labor Statistics, Employment Projections program						

State & Area Data

Occupational Employment Statistics (OES)

The Occupational Employment Statistics (OES) program produces employment and wage estimates annually for over 800 occupations. These estimates are available for the nation as a whole, for individual states, and for metropolitan and nonmetropolitan areas. The link(s) below go to OES data maps for employment and wages by state and area.

- Network and Computer Systems Administrators

Projections Central

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Career InfoNet

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Similar Occupations

This table shows a list of occupations with job duties that are similar to those of accountants and auditors.

Occupation	Job Duties	ENTRY-LEVEL EDUCATION	2014 MEDIAN PAY
Computer and Information Systems Managers	Computer and information systems managers, often called information technology (IT) managers or IT project managers, plan, coordinate, and direct computer-related activities in an organization. They help determine the information technology goals of an organization and are responsible for implementing computer systems to meet those goals.	Bachelor's degree	$127,640
Computer Hardware Engineers	Computer hardware engineers research, design, develop, and test computer systems and components such as processors, circuit boards, memory devices, networks, and routers. These engineers discover new directions in computer hardware, which generate rapid advances in computer technology.	Bachelor's degree	$108,430
Computer Network Architects	Computer network architects design and build data communication networks, including local area networks (LANs), wide area networks (WANs), and intranets. These networks range from small connections between two offices to next-generation networking capabilities such as a cloud infrastructure that serves multiple customers.	Bachelor's degree	$98,430

Computer Programmers	Computer programmers write and test code that allows computer applications and software programs to function properly. They turn the program designs created by software developers and engineers into instructions that a computer can follow.	Bachelor's degree	$77,550
Computer Support Specialists	Computer support specialists provide help and advice to people and organizations using computer software or equipment. Some, called computer network support specialists, support information technology (IT) employees within their organization. Others, called computer user support specialists, assist non-IT users who are having computer problems.	See How to Become One	$50,380
Computer Systems Analysts	Computer systems analysts study an organization's current computer systems and procedures and design information systems solutions to help the organization operate more efficiently and effectively. They bring business and information technology (IT) together by understanding the needs and limitations of both.	Bachelor's degree	$82,710
Database Administrators	Database administrators (DBAs) use specialized software to store and organize data, such as financial information and customer shipping records. They make sure that data are available to users and are secure from unauthorized access.	Bachelor's degree	$80,280

Electrical and Electronics Engineers	Electrical engineers design, develop, test, and supervise the manufacturing of electrical equipment, such as electric motors, radar and navigation systems, communications systems, and power generation equipment. Electronics engineers design and develop electronic equipment, such as broadcast and communications systems—from portable music players to global positioning systems (GPSs).	Bachelor's degree	$93,260
Information Security Analysts	Information security analysts plan and carry out security measures to protect an organization's computer networks and systems. Their responsibilities are continually expanding as the number of cyberattacks increases.	Bachelor's degree	$88,890
Software Developers	Software developers are the creative minds behind computer programs. Some develop the applications that allow people to do specific tasks on a computer or another device. Others develop the underlying systems that run the devices or that control networks.	Bachelor's degree	$97,990
Web Developers	Web developers design and create websites. They are responsible for the look of the site. They are also responsible for the site's technical aspects, such as its performance and capacity, which are measures of a website's speed and how much traffic the site can handle. In addition, web developers may create content for the site.	Associate's degree	$63,490

This table shows a list of occupations with job duties that are similar to those of network and computer systems administrators.

Contacts for More Information

For more information about Network and Computer Systems Administrators, visit

Association for Computing Machinery

IEEE Computer Society

CompTIA

For more information about opportunities for women pursuing information technology careers, visit

National Center for Women & Information Technology

O*NET

Network and Computer Systems Administrators

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OCCUPATIONAL OUTLOOK: SOFTWARE DEVELOPERS

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Software Developers

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Software Developers

Summary

Software developers design computer programs.

Quick Facts: Software Developers	
2014 Median Pay	$97,990 per year $47.11 per hour
Typical Entry-Level Education	Bachelor's degree
Work Experience in a Related Occupation	None
On-the-job Training	None
Number of Jobs, 2014	1,114,000
Job Outlook, 2014-24	17% (Much faster than average)
Employment Change, 2014-24	186,600

What Software Developers Do

Software developers are the creative minds behind computer programs. Some develop the applications that allow people to do specific tasks on a computer or another device. Others develop the underlying systems that run the devices or that control networks.

Work Environment

Many software developers work for firms that deal in computer systems design and related services or for software publishers

How to Become a Software Developer

Software developers usually have a bachelor's degree in computer science and strong computer programming skills.

Pay

The median annual wage for software developers was $97,990 in May 2014.

Job Outlook

Employment of software developers is projected to grow 17 percent from 2014 to 2024, much faster than the average for all occupations. The main reason for the rapid growth is a large increase in the demand for computer software.

State & Area Data

Explore resources for employment and wages by state and area for software developers.

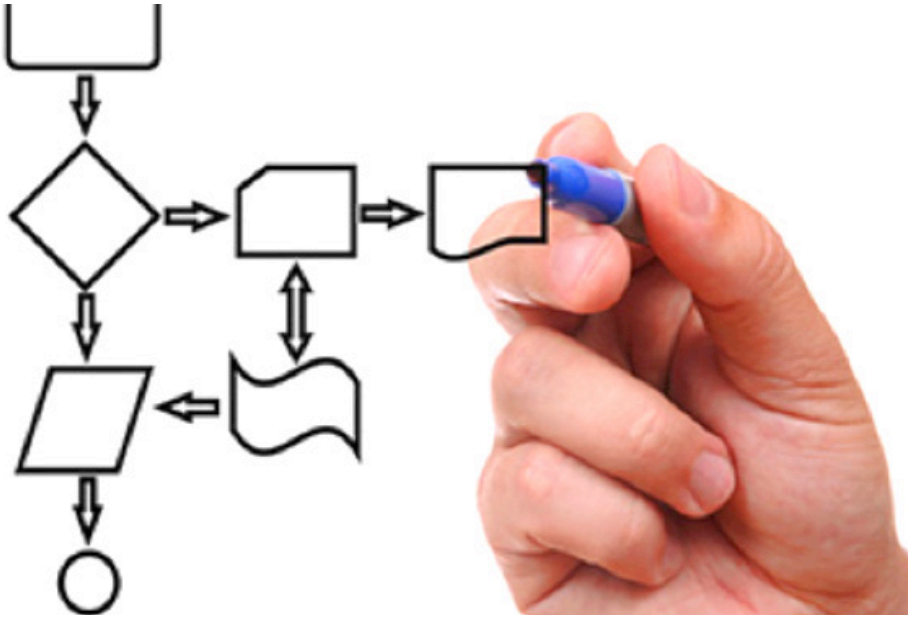
Similar Occupations

Compare the job duties, education, job growth, and pay of software developers with similar occupations.

More Information, Including Links to O*NET

Learn more about Software Developers by visiting additional resources, including O*NET, a source on key characteristics of workers and occupations.

What Software Developers Do



Developers create flow charts that help programmers write computer code.

Software developers are the creative minds behind computer programs. Some develop the applications that allow people to do specific tasks on a computer or another device. Others develop the underlying systems that run the devices or that control networks.

Duties

Software developers typically do the following:

- Analyze users' needs and then design, test, and develop software to meet those needs
- Recommend software upgrades for customers' existing programs and systems
- Design each piece of an application or a system and plan how the pieces will work together
- Create a variety of models and diagrams (such as flowcharts) that instruct programmers how to write software code

- Ensure that a program continues to function normally through software maintenance and testing
- Document every aspect of an application or a system as a reference for future maintenance and upgrades
- Collaborate with other computer specialists to create optimum software

Software developers are in charge of the entire development process for a software program. They may begin by asking how the customer plans to use the software. They must identify the core functionality that users need from software programs. Software developers must also determine user requirements that are unrelated to the functionality of software, such as the level of security and performance needs. They design the program and then give instructions to programmers, who write computer code and test it.

If the program does not work as expected or if testers find it too difficult to use, software developers go back to the design process to fix the problems or improve the program. After the program is released to the customer, a developer may perform upgrades and maintenance.

Developers usually work closely with computer programmers. However, in some companies, developers write code themselves instead of giving instructions to the programmers.

Developers who supervise a software project from the planning stages through implementation sometimes are called information technology (IT) project managers. These workers monitor the project's progress to ensure that it meets deadlines, standards, and cost targets. IT project managers who plan and direct an organization's IT department or IT policies are included in the profile on computer and information systems managers.

The following are examples of types of software developers:

Applications software developers design computer applications, such as word processors and games, for consumers. They may create custom software for a specific customer or commercial software to be sold to the general public. Some applications software developers create complex databases for organizations. They also create programs that people use over the Internet and within a company's intranet.

Systems software developers create the systems that keep computers functioning properly. These could be operating systems for computers that the general public buys or systems built specifically for an organization. Often, systems software developers also build the system's interface, which is what allows users to interact with the computer. Systems software developers are creating the operating systems that control most of the consumer electronics in use today, including the systems in phones or cars.

Work Environment

Developers may oversee a team of people during the software development process.

Software developers held about 1.1 million jobs in 2014. The industries that employed the most software developers were as follows:

Computer systems design and related services	33%
Software publishers	8
Finance and insurance	8
Computer and electronic product manufacturing	8
Management of companies and enterprises	4

Many software developers work for firms that deal in computer systems design and related services firms or for software publishers. Some systems developers work in computer- and electronic product–manufacturing industries. Applications developers work in office environments, such as offices of insurance carriers or corporate headquarters.

In general, software development is a collaborative process, and developers work on teams with others who also contribute to designing, developing, and programming successful software. However, some developers telecommute (work away from the office).

Work Schedules

Most software developers work full time, and long hours are common.

How to Become a Software Developer

Software developers usually have a bachelor's degree in computer science and strong computer-programming skills.

Software developers usually have a bachelor's degree in computer science and strong computer programming skills

Education

Software developers usually have a bachelor's degree, typically in computer science, software engineering, or a related field. A degree in mathematics is also acceptable. Computer science degree programs are the most common, because they tend to cover a broad range of topics. Students should focus on classes related to building software in order to better prepare themselves for work in the occupation. For some positions, employers may prefer a master's degree.

Although writing code is not their first priority, developers must have a strong background in computer programming. They usually gain this experience in school. Throughout their career, developers must keep up to date on new tools and computer languages.

Software developers also need skills related to the industry in which they work. Developers working in a bank, for example, should have knowledge of finance so that they can understand a bank's computing needs.

Other Experience

Many students gain experience in software development by completing an internship at a software company while in college.

Some software developers first work as computer programmers and then are given more responsibility as they gain experience. Eventually, they become developers.

Advancement

Software developers can advance to become information technology (IT) project managers, also called computer and information systems managers, a position in which they oversee the software development process.

Important Qualities

Analytical skills. Developers must analyze users' needs and then design software to meet those needs.

Communication skills. Developers must be able to give clear instructions to others working on a project. They must also explain to their customers how the software works and answer any questions that arise.

Computer skills. Developers must understand computer capabilities and programming languages in order to design effective software.

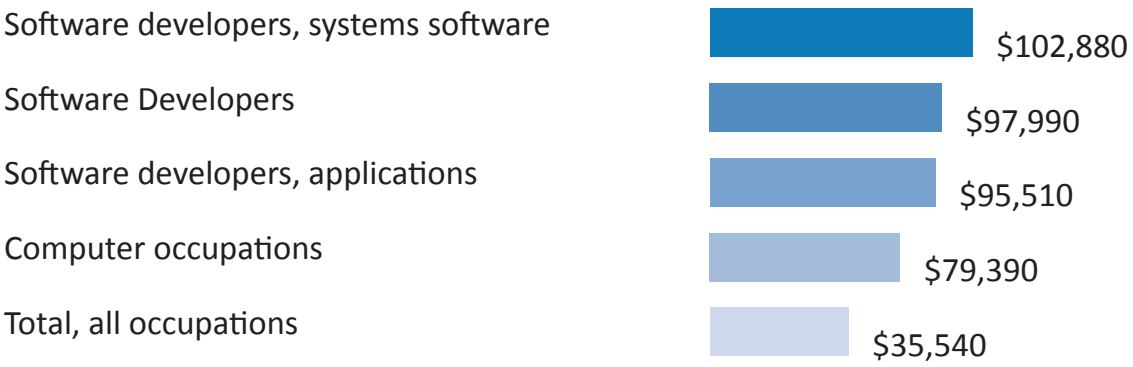
Creativity. Developers are the creative minds behind new computer software. Detail oriented. Developers often work on many parts of an application or system at the same time and must therefore be able to concentrate and pay attention to detail.

Interpersonal skills. Software developers must be able to work well with others who contribute to designing, developing, and programming successful software. Problem-solving skills. Because developers are in charge of software from beginning to end, they must be able to solve problems that arise throughout the design process.

Pay

Software Developers

Median annual wages, May 2014



Note: All Occupations includes all occupations in the U.S. Economy.
Source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics

The median annual wage for software developers, applications was $95,510 in May 2014. The median wage is the wage at which half the workers in an occupation earned more than that amount and half earned less. The lowest 10 percent earned less than $56,310, and the highest 10 percent earned more than $149,480. The median annual wage for software developers, systems software was $102,880 in May 2014. The lowest 10 percent earned less than $63,250, and the highest 10 percent earned more than $154,800.

In May 2014, the median annual wages for software developers in the top industries in which they worked were as follows:

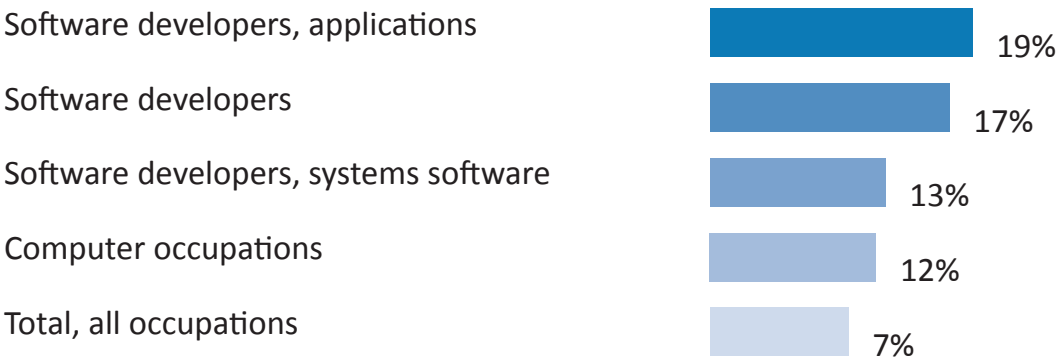
Computer and electronic product manufacturing	$109,810
Software publishers	106,580
Finance and insurance	98,060
Computer systems design and related services	95,270
Management of companies and enterprises	94,890

Most Software Developers work full time.

Job Outlook

Software Developers

Percent change in employment, projected 2014-24



Note: All Occupations includes all occupations in the U.S. Economy.
Source: U.S. Bureau of Labor Statistics, Employment Projections program

Employment of software developers is projected to grow 17 percent from 2014 to 2024, much faster than the average for all occupations. Employment of applications developers is projected to grow 19 percent, and employment of systems developers is projected to grow 13 percent. The main reason for the rapid growth in both applications developers and systems developers is a large increase in the demand for computer software.

The need for new applications on mobile devices and tablets will help increase the demand for application software developers.
The health and medical insurance and reinsurance carriers industry will need innovative software to manage new healthcare policy enrollments and administer existing policies digitally. As the number of people who use this digital platform increases over time, demand for software developers will grow.

Systems developers are likely to see new opportunities because of an increase in the number of products that use software. For example, more computer systems

are being built into consumer electronics and other products, such as cell phones and appliances.

Concerns over threats to computer security could result in more investment in security software to protect computer networks and electronic infrastructure. In addition, an increase in software offered over the Internet should lower costs and allow more customization for businesses, also increasing demand for software developers.

Some outsourcing to foreign countries that offer lower wages may occur. However, because software developers should be close to their customers, the offshoring of this occupation is expected to be limited.

Job Prospects

Job prospects will be best for applicants with knowledge of the most up-to-date programming tools and for those who are proficient in one or more programming languages.

Employment projections data for Software Developers, 2014-24

Occupational Title	SOC Code	Employment, 2014	Projected Employment, 2024	Change, 2014-24		Employment by Industry
				Percent	Numeric	
Software developers	—	1,114,000	1,300,600	17	186,600	—
Software developers, applications	15-1132	718,400	853,700	19	135,300	[XLSX]
Software developers, systems software	15-1133	395,600	447,000	13	51,300	[XLSX]

SOURCE: U.S. Bureau of Labor Statistics, Employment Projections program

State & Area Data

Occupational Employment Statistics (OES)

The Occupational Employment Statistics (OES) program produces employment and wage estimates annually for over 800 occupations. These estimates are available for the nation as a whole, for individual states, and for metropolitan and nonmetropolitan areas. The link(s) below go to OES data maps for employment and wages by state and area.

- Software developers, applications
- Software developers, systems software

Projections Central

Occupational employment projections are developed for all states by Labor Market Information (LMI) or individual state Employment Projections offices. All state projections data are available at www.projectionscentral.com. Information on this site allows projected employment growth for an occupation to be compared among states or to be compared within one state. In addition, states may produce projections for areas; there are links to each state's websites where these data may be retrieved.

Career InfoNet

America's Career InfoNet includes hundreds of occupational profiles with data available by state and metro area. There are links in the left-hand side menu to compare occupational employment by state and occupational wages by local area or metro area. There is also a salary info tool to search for wages by zip code.

Similar Occupations

This table shows a list of occupations with job duties that are similar to those of Software Developers.

Occupation	Job Duties	ENTRY-LEVEL EDUCATION	2014 MEDIAN PAY
Computer and Information Research Scientists	Computer and information research scientists invent and design new approaches to computing technology and find innovative uses for existing technology. They study and solve complex problems in computing for business, medicine, science, and other fields.	Doctoral or professional degree	$108,360
Computer and Information Systems Managers	Computer and information systems managers, often called information technology (IT) managers or IT project managers, plan, coordinate, and direct computer-related activities in an organization. They help determine the information technology goals of an organization and are responsible for implementing computer systems to meet those goals.	Bachelor's degree	$127,640
Computer Hardware Engineers	Computer hardware engineers research, design, develop, and test computer systems and components such as processors, circuit boards, memory devices, networks, and routers. These engineers discover new directions in computer hardware, which generate rapid advances in computer technology.	Bachelor's degree	$108,430

Computer Network Architects	Computer network architects design and build data communication networks, including local area networks (LANs), wide area networks (WANs), and intranets. These networks range from small connections between two offices to next-generation networking capabilities such as a cloud infrastructure that serves multiple customers.	Bachelor's degree	$98,430
Computer Programmers	Computer programmers write and test code that allows computer applications and software programs to function properly. They turn the program designs created by software developers and engineers into instructions that a computer can follow.	Bachelor's degree	$77,550
Computer Support Specialists	Computer support specialists provide help and advice to people and organizations using computer software or equipment. Some, called computer network support specialists, support information technology (IT) employees within their organization. Others, called computer user support specialists, assist non-IT users who are having computer problems.	See How to Become One	$50,380
Computer Systems Analysts	Computer systems analysts study an organization's current computer systems and procedures and design information systems solutions to help the organization operate more efficiently and effectively. They bring business and information technology (IT) together by understanding the needs and limitations of both.	Bachelor's degree	$82,710

Database Administrators	Database administrators (DBAs) use specialized software to store and organize data, such as financial information and customer shipping records. They make sure that data are available to users and are secure from unauthorized access.	Bachelor's degree	$80,280
Information Security Analysts	Information security analysts plan and carry out security measures to protect an organization's computer networks and systems. Their responsibilities are continually expanding as the number of cyberattacks increases.	Bachelor's degree	$88,890
Mathematicians	Mathematicians conduct research to develop and understand mathematical principles. They also analyze data and apply mathematical techniques to help solve real-world problems.	Master's degree	$103,720
Postsecondary Teachers	Postsecondary teachers instruct students in a wide variety of academic and career and technical subjects beyond the high school level. They also conduct research and publish scholarly papers and books.	See How to Become One	$70,790
Web Developers	Web developers design and create websites. They are responsible for the look of the site. They are also responsible for the site's technical aspects, such as its performance and capacity, which are measures of a website's speed and how much traffic the site can handle. In addition, web developers may create content for the site.	Associate's degree	$63,490

Contacts for More Information

For more information about advertising managers, visit

Association for Computing Machinery

IEEE Computer Society

Computing Research Association

CompTIA

For information about opportunities for women pursuing information technology careers, visit

National Center for Women & Information Technology

O*NET

Software Developers, Applications

Software Developers, Systems Software

OCCUPATIONAL OUTLOOK: WEB DEVELOPERS

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Web Developers

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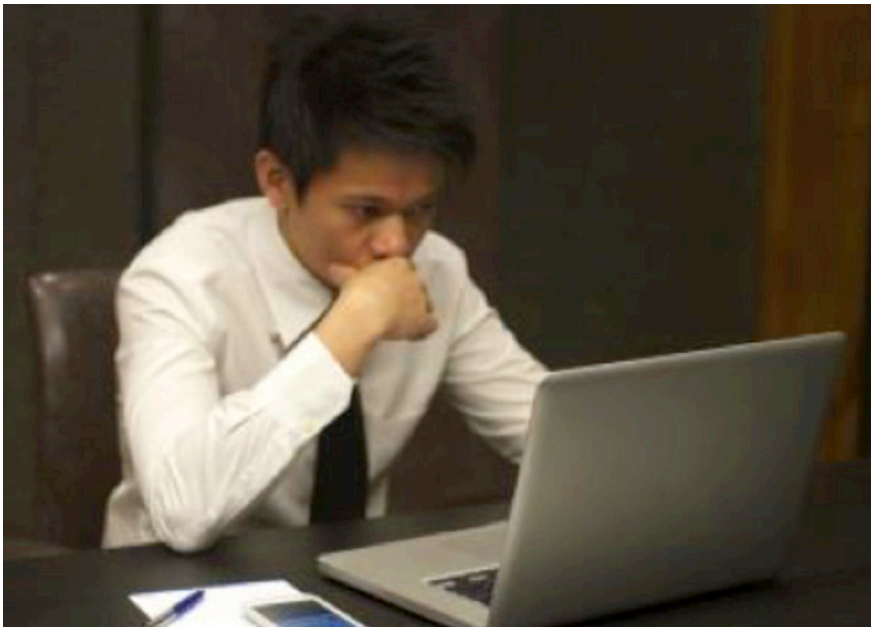
Web Developers

Summary



Web developers are responsible for both the look of a website and its technical aspects.

Quick Facts: Web Developers	
2014 Median Pay	$63,490 per year $30.52 per hour
Typical Entry-Level Education	Associate's degree
Work Experience in a Related Occupation	None
On-the-job Training	None
Number of Jobs, 2014	148,500
Job Outlook, 2014-24	27% (Much faster than average)
Employment Change, 2014-24	39,500

What Web Developers Do

Web developers design and create websites. They are responsible for the look of the site. They are also responsible for the site's technical aspects, such as its performance and capacity, which are measures of a website's speed and how much traffic the site can handle. In addition, web developers may create content for the site.

Work Environment

About 1 in 7 of web developers were self-employed in 2014. Non-self-employed developers work primarily in the computer systems design and related services industry.

How to Become a Web Developer

The typical education needed to become a web developer is an associate's degree in web design or related field. Web developers need knowledge of both programming and graphic design.

Pay

The median annual wage for web developers was $63,490 in May 2014.

Job Outlook

Employment of web developers is projected to grow 27 percent from 2014 to 2024, much faster than the average for all occupations. Demand will be driven by the growing popularity of mobile devices and ecommerce.

State & Area Data

Explore resources for employment and wages by state and area for web developers.

Similar Occupations

Compare the job duties, education, job growth, and pay of web developers with similar occupations.

More Information, Including Links to O*NET

Learn more about web developers by visiting additional resources, including O*NET, a source on key characteristics of workers and occupations.

What Web Developers Do

Some developers work on a website from the planning stages to completion.

Web developers design and create websites. They are responsible for the look of the site. They are also responsible for the site's technical aspects, such as its performance and capacity, which are measures of a website's speed and how much traffic the site can handle. In addition, web developers may create content for the site.

Duties

Web Developers typically do the following:

- Meet with clients or management to discuss the needs and design of a website
- Create and test applications for a website
- Write code for websites, using programming languages such as HTML or XML
- Work with other team members to determine what information the site will contain

- Work with graphics and other designers to determine the website's layout
- Integrate graphics, audio, and video into the website
- Monitor website traffic

When creating a website, developers have to make their client's vision a reality. They build particular types of websites, such as ecommerce, news, or gaming sites, to fit clients' needs. Different types of websites may require different applications to work right. For example, a gaming site should be able to handle advanced graphics, whereas an ecommerce site needs a payment-processing application. The developer decides which applications and designs will best fit the site.

Some developers handle all aspects of a website's construction, and others specialize in a certain aspect of it. The following are examples of types of specialized web developers:

Back-end web developers are responsible for the overall technical construction of the website. They create the basic framework of the site and ensure that it works as expected. Back-end web developers also establish procedures for allowing others to add new pages to the website and meet with management to discuss major changes to the site.

Front-end web developers are responsible for how a website looks. They create the site's layout and integrate graphics, applications (such as a retail checkout tool), and other content. They also write web-design programs in a variety of computer languages, such as HTML or JavaScript.

Webmasters maintain websites and keep them updated. They ensure that websites operate correctly, and they test for errors such as broken links. Many webmasters respond to user comments as well.

Work Environment

Developers build websites for all types of businesses.

Web developers held about 148,500 jobs in 2014. The industries that employed the most web developers were as follows:

Computer systems design and related services	20%
Educational services; state, local, and private	7
Religious, grantmaking, civic, professional, and similar organizations	5
Publishing industries (except Internet)	5
Other information services	5

About 1 in 7 of web developers were self-employed in 2014.

Work Schedules

Most web developers work full time.

How to Become a Web Developer

Developers often have both programming and graphic design knowledge.

The typical education needed to become a web developer is an associate's degree in web design or a related field. Web developers need knowledge of both programming and graphic design.

Education

Educational requirements for web developers vary with the setting they work in and the type of work they do. Requirements range from a high school diploma to a bachelor's degree. An associate's degree in web design or related field is the most common requirement.

However, for more technical developer positions, such as back-end web developers, some employers prefer workers who have at least a bachelor's degree in computer science, programming, or a related field.

Web developers need to have a thorough understanding of HTML programming. The most recent version, HTML5, contains new features that web developers need to understand. Many employers also want developers to understand other programming languages, such as JavaScript or SQL, as well as have some knowledge of multimedia publishing tools, such as Flash. Throughout their career, web developers must keep up to date on new tools and computer languages.

Some employers prefer web developers who have both a computer degree and coursework in graphic design, especially if the developer will be heavily involved in the website's visual appearance.

Advancement

Web developers who have a bachelor's degree can advance to become project managers. For more information, see the profile on computer and information systems managers.

Important Qualities

Concentration. Web developers must sit at a computer and write detailed code for long periods.

Creativity. Web developers often are involved in designing the appearance of a website and must make sure that it looks innovative and up to date.

Customer-service skills. Webmasters have to respond politely and correctly to user questions and requests.

Detail oriented. When web developers write in HTML, a minor error could cause an entire webpage to stop working

Pay

Web Developers

Median annual wages, May 2014

Note: All Occupations includes all occupations in the U.S. Economy.
Source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics

The median annual wage for web developers was $63,490 in May 2014. The median wage is the wage at which half the workers in an occupation earned more than that amount and half earned less. The lowest 10 percent earned less than $33,790, and the highest 10 percent earned more than $112,680.

In May 2014, the median annual wages for web developers in the top industries in which they worked were as follows:

Other information services	$67,270
Publishing industries (except Internet)	66,380
Computer systems design and related services	64,850
Religious, grantmaking, civic, professional, and similar organizations	59,170
Educational services; state, local, and private	58,930

Most web developers work full time.

Job Outlook

Web Developers

Percent change in employment, projected 2014-24

Note: All Occupations includes all occupations in the U.S. Economy.
Source: U.S. Bureau of Labor Statistics, Employment Projections program

Employment of web developers is projected to grow 27 percent from 2014 to 2024, much faster than the average for all occupations.

Employment of web developers is projected to grow as ecommerce continues to expand. Online purchasing is expected to grow faster than the overall retail industry. As retail firms expand their online offerings, demand for web developers will increase. In addition, an increase in the use of mobile devices to search the web will lead to an increase in employment of web developers. Instead of designing a website for a desktop computer, developers will have to create sites that work on mobile devices with many different screen sizes, leading to more work.

Because websites can be built from anywhere in the world, some web developer jobs may be moved to countries with lower wages, decreasing employment growth. However, this practice may decline because the cost of managing web developers in multiple countries can offset the savings to businesses. Furthermore, web developers must understand cultural nuances that allow webpages to communicate effectively with users, and domestic web developers are better equipped for this task, curtailing the work that may be moved to other countries.

Job Prospects

Job opportunities for web developers are expected to be good. Those with knowledge of multiple programming languages and digital multimedia tools, such as Flash and Photoshop, will have the best opportunities.

Employment projections data for Web Developers, 2014-24

Occupational Title	SOC Code	Employment, 2014	Projected Employment, 2024	Change, 2014-24		Employment by Industry
				Percent	Numeric	
Web developers	15-1134	148,500	188,000	27	39,500	[XLSX]
SOURCE: U.S. Bureau of Labor Statistics, Employment Projections program						

State & Area Data

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- Web Developers

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Similar Occupations

This table shows a list of occupations with job duties that are similar to those of Web Developers.

Occupation	Job Duties	ENTRY-LEVEL EDUCATION	2014 MEDIAN PAY
Computer and Information Systems Managers	Computer and information systems managers, often called information technology (IT) managers or IT project managers, plan, coordinate, and direct computer-related activities in an organization. They help determine the information technology goals of an organization and are responsible for implementing computer systems to meet those goals.	Bachelor's degree	$127,640
Computer Programmers	Computer programmers write and test code that allows computer applications and software programs to function properly. They turn the program designs created by software developers and engineers into instructions that a computer can follow.	Bachelor's degree	$77,550
Computer Support Specialists	Computer support specialists provide help and advice to people and organizations using computer software or equipment. Some, called computer network support specialists, support information technology (IT) employees within their organization. Others, called computer user support specialists, assist non-IT users who are having computer problems.	See How to Become One	$50,380

Computer Systems Analysts	Computer systems analysts study an organization's current computer systems and procedures and design information systems solutions to help the organization operate more efficiently and effectively. They bring business and information technology (IT) together by understanding the needs and limitations of both.	Bachelor's degree	$82,710
Database Administrators	Database administrators (DBAs) use specialized software to store and organize data, such as financial information and customer shipping records. They make sure that data are available to users and are secure from unauthorized access.	Bachelor's degree	$80,280
Graphic Designers	Graphic designers create visual concepts, using computer software or by hand, to communicate ideas that inspire, inform, and captivate consumers. They develop the overall layout and production design for various applications such as advertisements, brochures, magazines, and corporate reports.	Bachelor's degree	$45,900
Information Security Analysts	Information security analysts plan and carry out security measures to protect an organization's computer networks and systems. Their responsibilities are continually expanding as the number of cyberattacks increases.	Bachelor's degree	$88,890
Multimedia Artists and Animators	Multimedia artists and animators create animation and visual effects for television, movies, video games, and other forms of media.	Bachelor's degree	$63,630

Software Developers	Software developers are the creative minds behind computer programs. Some develop the applications that allow people to do specific tasks on a computer or another device. Others develop the underlying systems that run the devices or that control networks.	Bachelor's degree	$97,990

Contacts for More Information

For more information about advertising managers, visit

World Organization of Webmasters

For more information about computer careers, visit

Association for Computing Machinery

IEEE Computer Society

Computing Research Association

For information about opportunities for women pursuing information technology careers, visit

National Center for Women & Information Technology

O*NET

Web Developers