



Computer Engineering Overview

The Field - Preparation - Accreditation -
Day in the Life - Professional Societies - Earnings

The Field

Computer engineers (or computer hardware engineers) research, design, develop, test, and oversee the manufacture and installation of computer hardware, including computer chips, circuit boards, computer systems, and related equipment such as keyboards, routers, and printers. This field should not be confused with computer software engineers, who design and develop the software systems that control computers.

The work of computer hardware engineers is similar to that of electronics engineers in that they may design and test circuits and other electronic components; however, computer hardware engineers do that work only as it relates to computers and computer-related equipment. The rapid advances in computer technology are largely a result of the research, development, and design efforts of these engineers.

They work on the design, planning, development, testing, and even the supervision of manufacturing of computer hardware -- including everything from chips to device controllers. They also focus on computer networks for the transmission of data and multimedia.

They work on the interface between different pieces of hardware and strive to provide new capabilities to existing and new systems or products. The work of a computer engineer is grounded in the hardware -- from circuits to architecture -- but also focuses on operating systems and software. Computer engineers must understand logic design, microprocessor system design, computer architecture, computer interfacing, and continually focus on system requirements and design.

It is primarily software engineers who focus on creating the software systems used by individuals and businesses, but computer engineers may also design and develop some software applications.



"Computer Engineering Overview"

Prepared by the Sloan Career Cornerstone Center.

More details and additional information is at www.careercornerstone.org.

Preparation

Students studying computer engineering may choose to focus on specialty areas including artificial intelligence (intelligent systems for applications such as robotics, language understanding, knowledge acquisition, reasoning, computer vision, and pattern recognition), computer systems (the design and analysis of computers including the topics of VLSI (Very Large Scale Integration) systems, computer architecture, computer networks, and integrated circuits), or systems and computations (including the integration of both hardware and software into a coherent system). They must have strong analytical skills and be detail oriented. In addition, they must work well in team situations as they are often called upon to work in a group setting with other engineers and with others outside of engineering. A bachelor's degree in engineering is required for almost all entry-level engineering jobs.

► Admission Requirements

Admissions requirements for undergraduate engineering schools include a solid background in mathematics (algebra, geometry, trigonometry, and calculus) and science (biology, chemistry, and physics), and courses in social studies, humanities, and computer and information technology. Bachelor's degree programs in engineering typically are designed to last 4 years, but many students find that it takes between 4 and 5 years to complete their studies. In a typical 4-year university curriculum, the first 2 years are spent studying mathematics, basic sciences, introductory engineering, humanities, and social sciences. In the last 2 years, most courses are in engineering, usually with a concentration in one branch. For example, a computer engineering program might include courses in computer hardware, microcomputers, software engineering, digital signal and image processing, electromagnetic fields, electronic devices and circuits, and computer organization and design.



► Co-ops

Internships and Coops provide students with a great opportunity to gain real-world experience while still in school. Many universities offer co-op and internship programs for students studying Computer Engineering.

► Courses of Study

Students specializing in Computer Engineering will study computer hardware, microcomputers, software engineering, digital signal and image processing, electromagnetic fields, electronic devices and circuits, and computer organization and design. They will likely take courses in linear algebra, data structures and software principles. Computer Engineers also need to develop strong communication skills.

► Ongoing Study

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

"Computer Engineering Overview"

Prepared by the Sloan Career Cornerstone Center.

More details and additional information is at www.careercornerstone.org.

Specialty Areas

Most computer engineers are further classified by specific areas of focus. The following is a list of several major specialty areas within computer engineering:

- ▶ Coding, Cryptography, and Information Protection
- ▶ Communications and Wireless Networks
- ▶ Compilers and Operating Systems
- ▶ Computational Science and Engineering
- ▶ Computer Networks, Mobile Computing, and Distributed Systems
- ▶ Computer Systems: Architecture, Parallel Processing, and Dependability
- ▶ Computer Vision and Robotics
- ▶ Embedded Systems
- ▶ Integrated Circuits, VLSI Design, Testing, and CAD
- ▶ Signal, Image, and Speech Processing

Accreditation

Those interested in a career in engineering should consider reviewing engineering programs that are accredited by the official accrediting agency for their country. More details are at www.accreditation.org, but in general, accreditation helps ensure that a program offers a consistently high standard of education in a specific field. The process of accreditation also serves to foster self-examination by universities; to develop a dialog between constituents of educational programs on content, methods, and outcomes; and to encourage continuous improvement of academic programs.



Day in the Life

Computer engineers are concerned with the design, development, and implementation of computer technology into a wide range of consumer, industrial, commercial, and military applications. In automobiles design, for example, computers are integrated into many systems, including air conditioning, navigation, audio and video systems, and even tire pressure alert systems. As more and more products incorporate or interact with computers, computer engineers are challenged to develop computer applications that improve the quality of life while being sensitive to manufacturing and distribution costs.

"Computer Engineering Overview"

Prepared by the Sloan Career Cornerstone Center.

More details and additional information is at www.careercornerstone.org.

Teams and Coworkers

Almost all jobs in engineering require some sort of interaction with coworkers. Whether they are working in a team situation, or just asking for advice, most engineers have to have the ability to communicate and work with other people. Engineers should be creative, inquisitive, analytical, and detail-oriented. They should be able to work as part of a team and to communicate well, both orally and in writing. Communication abilities are important because engineers often interact with specialists in a wide range of fields outside engineering. Writing and presentation skills are also vital so engineers can share their research and experiences with colleagues through topical meetings, professional associations, and various publications.

Tasks

Computer engineers work on hardware, software and the interface between the two. They work in teams with other engineers and others from other areas to design, build, and maintain systems that incorporate or use computers. Working as a computer engineer requires expertise in both computer hardware and software, and requires the engineer to be able to recommend tradeoffs between hardware and software to create a system or product design that is cost effective and useful.

The Workplace

Computer engineers usually work in offices or laboratories in comfortable surroundings. They usually work about 40 hours a week -- the same as many other professional or office workers do. However, evening or weekend work may be necessary to meet deadlines or solve specific problems. Given the technology available today, telecommuting is common for computer professionals. As networks expand, more work can be done from remote locations through modems, laptops, electronic mail, and the Internet. Computer Engineers are employed in industry, government, education, and consulting. It is difficult to find a company that doesn't require the expertise of computer engineers for its products or systems.

Professional Societies

Professional organizations and associations provide a wide range of resources for planning and navigating a career in engineering. These groups can play a key role in your development and keep you abreast of what is happening in your industry. Many offer opportunities for university students to become members and provide programs and resources to pre-university students considering a career path.

Earnings

Earnings for engineers vary significantly by specialty, industry, location, and education. Even so, as a group, engineers earn some of the highest average starting salaries among those holding bachelor's degrees. Many professional societies keep track of earnings in their area of focus and geographic base.

"Computer Engineering Overview"

Prepared by the Sloan Career Cornerstone Center.

More details and additional information is at www.careercornerstone.org.