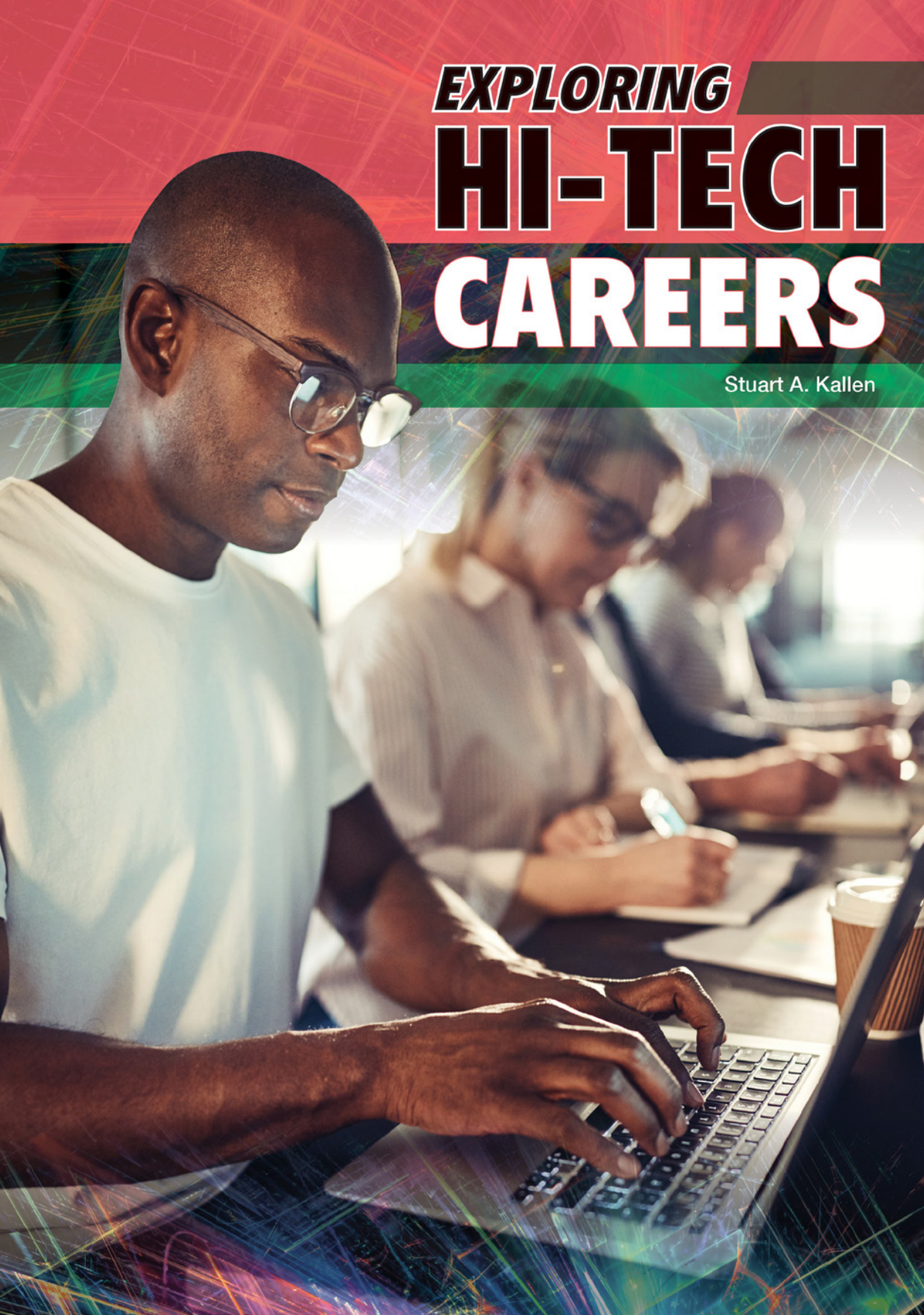




EXPLORING **HI-TECH** **CAREERS**

Stuart A. Kallen



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For more information, contact:

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Software Developer

What Does a Software Developer Do?

In 2002 engineer Elon Musk founded the aerospace manufacturing company SpaceX to produce space vehicles, rocket engines, and communications satellites. By 2021 SpaceX had employed nearly ten thousand people, from meteorologists to rocket propulsion scientists. Hundreds of SpaceX employees work as software developers. These skilled professionals write software code that is used to design, test, build, and control a wide range of high-tech machinery including launch equipment, rocket engines, satellites, and spacecraft. In 2020 a SpaceX software developer earned more than \$110,000 annually, on average.

Most software developers have jobs that are more earth-bound, but they can earn equally stratospheric salaries. That

is because the work of software developers is in high demand. These creative people build computer programs that support major industries, such as electronics, aeronautics, automotive, finance, insurance, health care, entertainment, and social media. Without the apps developed by software developers, there would be no cellphones, GPS, computers, video games, streaming movies, or World Wide Web.

Beyond developing specific apps, software devel-

A FEW FACTS

- **Number of Jobs:** 1,469,200 in 2019
- **Median Annual Pay:** \$107,510 in 2019
- **Educational Requirements:** Bachelor's degree
- **Personal Qualities:** Good communicator, sharp coding skills, analytical, detail oriented
- **Work Settings:** Remote or on-site office; some overtime work
- **Future Job Outlook:** 22 percent growth through 2029

opers write firmware, a type of software that runs almost all the machinery used in daily life. While SpaceX spacecraft use firmware, so do dishwashers, televisions, and cars. As a software developer known as UpGrad explains, “In layman terms, a software developer is someone who brings the computer to life . . . an individual [who] takes charge of the entire process of creating versatile and functional software for unique kinds of operating systems. From writing the code . . . [to encrypting] it and testing it.”⁹

The job of software developer involves inventing imaginative new ways to perform a digital task. These digital developers follow a step-by-step process that begins with analyzing a user’s needs and designing an application—say, a cellphone app—to meet those needs. From there, software developers work with coders who write the tens of thousands of lines of code that make an app function.

After an application is created, software developers test the app to ensure it is working perfectly. Performance and security functions are added depending on the wishes of the client. After creating apps, software developers create models, instructions, and diagrams called flowcharts for other programmers to follow if they need to further improve and test the app. Once a program is finished, a software developer tracks its performance. As UpGrad points out, “Software creation is not the only job of a software developer. They are required to pay attention to user feedback, their suggestions, and [incorporate] these suggestions into the existing software infrastructure to continually improve it.”¹⁰

Newly created applications can have bugs (glitches) or be difficult to use. Failure is part of the job, and software developers need to have the mental strength to deal with frustration, disappointment, and stress. Software developer Nick Ang says he takes walks when he is confronted with difficulties, or sometimes he sleeps on a problem. He explains, “But here’s the thing about coding: there is always a way to design a solution to a problem. And the sweet relief that comes from finishing a difficult task can only be described as euphoria.”¹¹



Software developers invent imaginative new ways to perform digital tasks. They also write the lines of code that make the software function. Finally, they track performance, making adjustments when needed.

Software developers often specialize in certain aspects of the job. Application software developers, as the name implies, concentrate on computer applications designed for individual users. These developers create games, word processors, photo and video apps, financial software, databases, and hundreds of other applications. The products created by application software developers may be sold to the public, government agencies, and businesses.

Systems software developers create computer operating systems that perform basic functions for computers, cellphones, tablets, video game systems, and other consumer electronics. These programs run in the background but are not developed for individual users. Developers who oversee the complete creation of an app from planning stage through distribution are called IT project managers. In addition to developing an app, they are responsible for meeting budgets, deadlines, and quality standards, as well as supervising others working on the project.

Some software developers start their own companies, and a few have earned great fame and fortune as the most influential software developers of all time. For example, Facebook founder Mark Zuckerberg began developing software while still in high school, and Bill Gates established his reputation as a software developer in high school and went on to found Microsoft, one of the world's most successful software companies.

A Typical Workday

Software developers spend long hours ensuring their apps are user friendly. Most begin their day going through emails from clients and users who need guidance or have discovered problems with an application. Meetings are another major part of the workday because software developers often work in teams. Some participate in a daily ritual called a standup or a scrum. The term *scrum* is taken from the rough game of rugby. It describes a meeting in which members put their heads together and discuss their work, the goals they hope to achieve, and the impediments blocking those goals. Software developer Alex Katsero leads the scrum at the software company Dashbird. “We each discuss our progress during the [scrum] and raise any obstacles or blockers we’re facing,” he explains. “It’s a really social, helpful, and fun way for us to check-in with each other, especially useful when working remotely, and to have a forum to reflect on what did and didn’t work before. . . . Brainstorming ideas is always encouraged, as is breaking off into smaller groups to resolve issues.”¹²

Testing and Debugging

Software developers have to regularly maintain and monitor the efficacy of . . . software systems—new and existing. In case there are any issues that come up on the existing software platforms, software developers have to find solutions to those problems and eliminate them in proper time. [The job] includes running [quality assurance] tests continuously and rewriting the code to debug it. This process will continue until the code is completely error-free.

—UpGrad, software developer

UpGrad, “What Do Software Developers Do?,” Quora, 2021. www.quora.com.

Education and Training

Most software developers have a bachelor's degree in computer science, software engineering, or a related field. Computer science degree programs are considered the most helpful because the courses cover topics such as software design, information and database systems, operating systems, data structures, encryption, and algorithms.

Prospective software developers can start out in high school by taking as many math courses as possible, including calculus, trigonometry, and algebra. Computer science courses that emphasize programming languages are helpful, as are classes in physics, chemistry, and communications.

Not all software developers have a college education. According to a 2018 study by the technology hiring platform HackerRank, around a third of software developers are self-taught. They take online courses in software development and learn programming languages like Ruby, Python, and JavaScript. Those who are self-taught often work as freelancers—that is, they are self-employed and do not receive employee benefits like health insurance and vacation pay that come with being an employee of an established tech company.

Whether a software developer is self-taught or is a graduate of a major university, internships provide vital experience that hiring managers look for on a résumé. Software developer interns learn to work on projects from start to finish and develop the analytical thinking skills necessary for a successful career. Interns work with mentors who share their knowledge and experience with the intern. Perhaps most important, internships often lead to a job offer.

Skills and Personality

Software developer Max Poshusta put together a slyly humorous list of skills he relies on to pursue his profession: “Teacher, Tinkerer, Puzzle Solver, Ninja, . . . Architect, Scientist, Mathematician, [and] Comedian.” Poshusta says these talents help him “build the unbuildable.”¹³ While few software developers are born with all these skills—especially ninja and comedian—a sense of humor comes in handy when working on highly complex tasks

Coordinating Tasks with Stand-Ups

Stand-ups are very short meetings where a team of 3 to 8 developers gather in the morning to prioritize each person's tasks. The product manager and a designer in the team will also likely join, if that team has them. . . . The point of stand-ups is to ensure that software developers work as a team by facilitating constant communication. I find that developers' meetings are usually much more concise than meetings of the business type because the nature of software development work is that we are always working on [distinct] tasks with clear end states.

—Nick Ang, software developer

Nick Ang, "A Day in the Life of a Software Developer," nickang.com, January 2, 2020. www.nickang.com.

with teams of programmers, engineers, business and marketing executives, and nontechnical personnel. Good communication skills are also important; software developers are often required to provide clear instructions to others working on a project and to explain detailed software applications to customers.

Software developers require sharp analytical skills to search out bugs in code and find solutions to problems. The work requires attention to detail because a developer writes thousands of lines of code that must function flawlessly from start to finish (a typical iPhone app has almost a hundred thousand lines of code). And finding new ways to perform tasks requires a creative mind that can think outside the box when it comes to design and innovation.

Working Conditions

Software developers generally work forty-hour weeks but can expect to put in overtime hours when deadlines loom or bugs are found. The job often involves long hours at a keyboard. Ang notes, "The bulk of a day's work for a software developer is to sit quietly at his multiple screens and mechanical keyboard and read/write code."¹⁴

Employers and Pay

According to the Bureau of Labor Statistics (BLS), the median annual wage for software developers in 2019 was \$107,510.

The highest 10 percent of software developers earned more than \$164,590 while the lowest 10 percent earned less than \$64,240. Software publishers paid application software developers the highest wage, averaging around \$122,000, whereas computer systems designers were paid around \$103,670.

What Is the Future Outlook for Software Developers?

There is a skyrocketing demand for new computer software in nearly every economic sector. This has created a very promising job outlook for software developers. The BLS predicts that demand for software developers will grow by 22 percent through 2029. Sometimes software developers can advance to the role of an information technology project manager or information systems manager. In these positions they oversee the complete software development process.

Find Out More

Association of Software Professionals (ASP)

<https://asp-software.org/www>

This organization is made up of independent software developers who have created freeware and shareware. The website features the popular Portable Application Description (PAD) format used by more than forty thousand software publishers to provide product descriptions and specifications to online sources in a standard way. Students can access ASP to learn from successful developers of desktop and laptop programs and cloud computing and mobile apps.

IEEE Computer Society

www.ieee.org

The IEEE offers students a wide range of learning, career, and employment opportunities. The organization's Standards University offers courses, games, videos, an e-magazine, and an eLearning library. In addition, the IEEE provides certifications for computer professionals.

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Mikhail Karan has been the lead software developer for the media player Contentling since 2016 and is the co-owner of the software development company Digital Dynasty Design. The following interview was conducted by email.

Q: Why did you become a software developer?

A: When I graduated college, a friend and I wanted to try starting an IT business. We had a contract lined up even before finishing our final exams. This led us to creating websites for multiple clients, which is where our business headed. We eventually took on larger projects that required more software development skills. Using a combination of the skills I learned from post-secondary [education] and self-teaching, I took on a software developer role, focusing on web and mobile app development. Solving problems and learning new technologies was something I liked to do, so this new part of our business fit my interests.

Q: What is your educational background?

A: I started off in engineering at McMaster University (in Hamilton, Ontario) right after high school but quickly realized I was in over my head. I dropped out and took computer engineering technology at Mohawk Community College. It was a three-year course with a work placement option. After finishing, I decided to continue at the university where I got my Software Engineering Technology bachelor's.

Q: Can you describe your typical workday?

A: I start my workday with task management and project planning. I get my day fully planned out, which can take anywhere between thirty minutes to an hour. I then dive into one of the tougher programming tasks that I have that day; I'm more productive in the mornings so I like to tackle the difficult tasks right away. Usually by the time I finish the tougher tasks, my meetings for the day begin. From around 12 p.m. to 3 p.m. I'm in communication with my team in

OTHER HI-TECH JOBS

Applications engineer	Front end developer
Applications support analyst	IT analyst
Business analyst	Java developer
Cloud consultant	Management information systems director
Computer and information research scientist	Mobile developer
Computer hardware engineer	Network architect
Computer programmer	Network engineer
Computer scientist	Social media manager
Computer support specialist	Software tester
Content manager	System architect
Data center support specialist	Systems designer
Data quality manager	Technical specialist
Digital marketing manager	Technical support engineer
Director of technology	Telecommunications specialist
Electrical and electronics engineer	User interface designer
Frameworks specialist	Web administrator
	Web analytics developer

Editor's note: The US Department of Labor's Bureau of Labor Statistics provides information about hundreds of occupations. The agency's *Occupational Outlook Handbook* describes what these jobs entail, the work environment, education and skill requirements, pay, future outlook, and more. The *Occupational Outlook Handbook* may be accessed online at www.bls.gov/ooh.

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