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Why computer occupations are behind strong STEM employment growth in the 2019–29 decade

By Alan Zilberman and Lindsey Ice

Science, technology, engineering, and mathematics (STEM) occupations are projected to grow over two times faster than the total for all occupations in the next decade. The U.S. Bureau of Labor Statistics (BLS) 2019–29 employment projections show that occupations in the STEM field are expected to grow 8.0 percent by 2029, compared with 3.7 percent for all occupations.

Even though many STEM occupations are expected to enjoy faster than average employment growth in the 2019–29 decade, high demand for computer occupations is largely behind the expected increase in STEM employment in the next decade.

This **Beyond the Numbers** article gives an overview of three computer occupations that are expected to experience rapid employment growth in the next decade and the trends responsible for their strong growth. A growing digital economy, accelerated in particular by the expansion of Internet of Things (IoT), is a driving force behind this projected growth. Internet of Things refers to the network of physical objects that are connected to the internet via embedded sensors or software, such as wearable fitness trackers or connected appliances. Internet connectivity allows these objects to connect with other devices or systems and send or receive data. At the same time, the increased importance of data has led to a greater need for data security amid the rising threat of data breaches.

Employment projections for STEM occupations

Computer occupations as a group are projected to grow about 3 times as fast as the average between 2019 and 2029 at 11.5 percent. This growth will result in slightly more than half a million new computer jobs over the 10-year period. The three computer occupations discussed below are all poised to grow at rates above 15.0 percent over the next 10 years.

It is important to note that the mathematical science occupational group is projected to grow the fastest among all STEM occupational groups. However, these occupations, which include data scientists, mathematicians, and statisticians, are relatively small and represent only 2 percent of all STEM jobs in 2019. Moreover, mathematical science occupations are projected to account for only 7 percent of all new STEM jobs added by 2029, whereas computer occupations are projected to make up two-thirds of all new STEM jobs created.

Table 1. Projected employment by STEM occupational group, 2019–29

Occupation title	Employment		Percent change	Employment change
	2019	2029	2019–29	2019–29
STEM occupations	**9,955.1**	**10,752.9**	**8.0**	**797.8**
Computer occupations	4,633.4	5,164.6	11.5	531.2
Engineers	1,810.1	1,879.1	3.8	69.0
Life scientists	344.8	361.4	4.8	16.6
STEM post secondary teachers [1]	294.1	308.8	5.0	14.7
Physical scientists	276.6	291.4	5.3	14.7
Mathematical science occupations	211.7	267.8	26.5	56.1

[1] Aggregate employment for 11 different STEM post-secondary teacher occupations.
Notes: Employment numbers in thousands.
Not all STEM occupations are represented in the table above. A complete list of occupations included in the STEM definition is available at www.bls.gov/oes/stem_list.xlsx.
Source: U.S. Bureau of Labor Statistics.

Projected employment growth by computer occupation

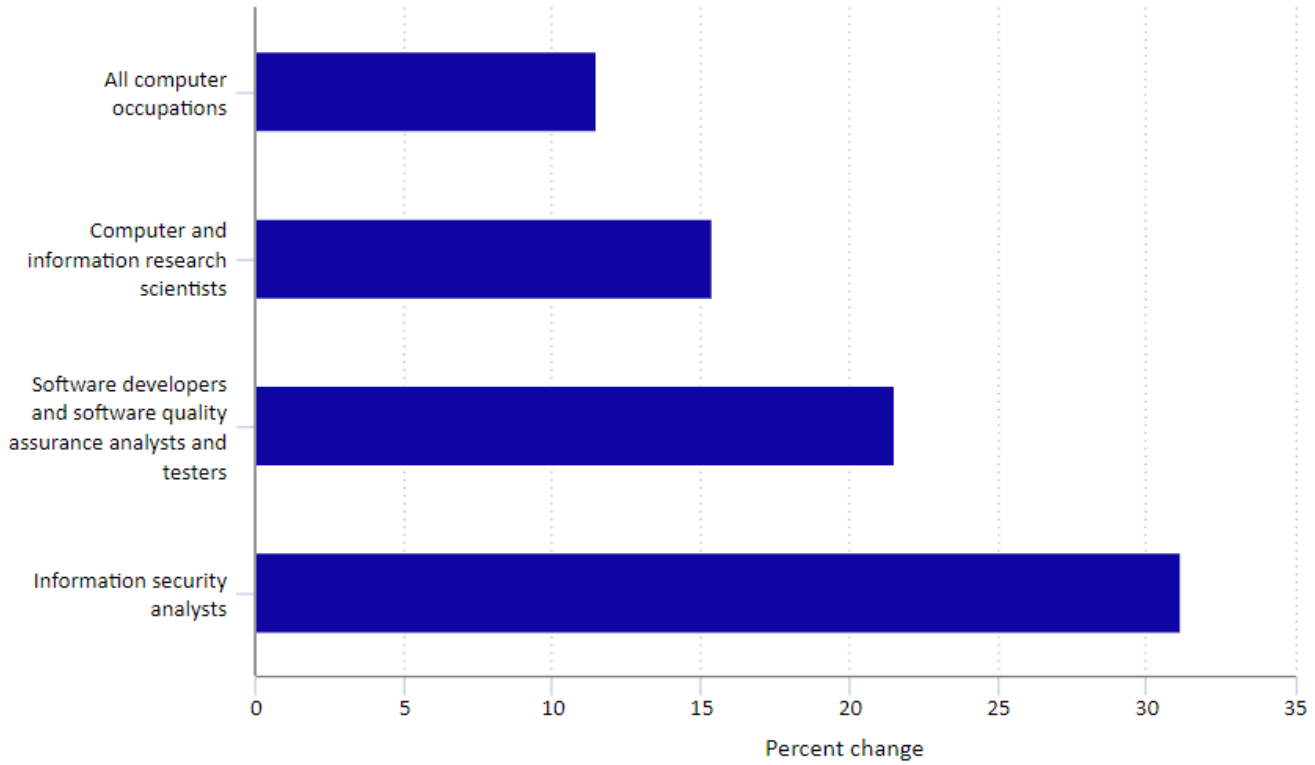
Information security analysts plan and carry out security measures to protect an organization's computer networks and systems. They also install and use software, such as firewalls and data encryption programs, to

protect sensitive information. Employment of information security analysts is projected to grow 31.2 percent, making this occupation the tenth fastest growing occupation among all 800 occupations.

Software developers are the creative minds behind computer programs. They develop the applications that allow people to do specific tasks on a computer or other device, designing each piece of an application or system and planning how the pieces will work together. Other developers create the operating systems that keep computers functioning properly. Employment of software developers and software quality assurance analysts and testers is projected to grow 21.5 percent.

Computer and information research scientists invent and design new approaches to computing technology and find innovative uses for existing technology. They study complex computing problems in science, medicine, business and other fields. They work with algorithms to build and improve programs, invent new computing languages, use theory to solve technological problems, and advance new technologies. Employment of computer and information research scientists is projected to grow 15.4 percent.

Chart 1. Projected percent change by selected computer occupations, 2019–29



Hover over chart to view data.
Source: U.S. Bureau of Labor Statistics.

Table 2. Computer occupations, projected employment, 2019–29

Occupation title	Employment		Percent change	Employment change
	2019	2029	2019–29	2019–29
Total, all occupations	**162,795.6**	**168,834.7**	**3.7**	**6,039.2**
Computer occupations	**4,633.4**	**5,164.6**	**11.5**	**531.2**

See footnotes at end of table.

Table 2. Computer occupations, projected employment, 2019–29

Occupation title	Employment		Percent change	Employment change
	2019	2029	2019–29	2019–29
Information security analysts	131	171.9	31.2	40.9
Software developers and software quality assurance analysts and testers	1,469.2	1,785.2	21.5	316
Computer and information research scientists	32.7	37.7	15.4	5
Database administrators and architects	132.5	145.3	9.7	12.8
Web developers and digital interface designers	174.3	188.3	8	14
Computer user support specialists	687.2	741.9	8	54.8
Computer systems analysts	632.4	679	7.4	46.6
Computer network support specialists	195.1	207.7	6.4	12.6
Computer network architects	160.1	168.1	5	8
Network and computer systems administrators	373.9	389.9	4.3	16
Computer programmers	213.9	193.8	-9.4	-20.1

Note: Employment numbers in thousands.
Source: U.S. Bureau of Labor Statistics.

What's driving growth in these occupations?

Computer occupations are projected to be in such high demand over the next 10 years due to continued growth in the digital economy. Notable components of this include an expected surge in the number of connected devices and an expected rise in the risk from data breaches.

A growing digital economy bolsters demand for computer occupations

From online shopping to the use of social media platforms, society has become increasingly dependent on digitized devices, and digital goods and services have become an important driver of U.S. economic growth. The Bureau of Economic Analysis (BEA) estimates the digital economy was worth $1.8 trillion in current prices in 2018, representing 9.0 percent of gross domestic product (GDP).[1] Moreover, the digital economy grew faster than the overall economy at an average rate of 6.8 percent from 2006 to 2018, compared with 1.7 percent for the total economy.[2]

Over the next 10 years, the United States will continue to be transformed by technological advancements rooted in computer programs and applications. The increased development and deployment of IoT, artificial intelligence, robotics, machine learning, and other technologies in the marketplace are expected to continue to change our workplaces and lives. The World Economic Forum estimates that over 60 percent of global GDP will be digitized by 2022, and 70 percent of new value created in the global economy over the next decade will be based on business models with digitally enabled platforms.[3]

According to a report by the United Nations, the United States and China are the world's leaders in the global digital economy. Combined, they account for 50 percent of global spending on IoT, more than 75 percent of the world market for public cloud computing, and 90 percent of the market capitalization of the world's 70 largest digital platforms.[4]

Computer occupations will be on the frontlines of the technological advancements propelling robust growth in the digital economy. Computer and information research scientists will play an important role in solving the complex

computing challenges posed by these technologies, while software developers will be needed to design the applications and software needed to run them. In addition, information security analysts will be needed to ensure that new technologies are secure from outside threats or hacks.

The role of IoT in fueling digital economic growth

A major driver in the robust expansion of the digital economy over the next decade will be the increasing connectivity among smart devices. The popularity of these devices started to grow in 2014, when large technology companies like Google began acquiring smaller businesses that produce smart devices.[5] As IoT continues to gain momentum, information security analysts, software developers, and computer and information research scientists will be in high demand for their role in its development, applications, and security.

One example of an IoT-connected device is a smart thermostat, which can be synced and programmed through a smartphone. While most homes did not have a smart thermostat or any smart home device just several years ago, sales of smart thermostats are on the rise, and their installation in new homes has become an industry standard.[6] Another popular IoT-enabled device is a voice activated assistant. By the end of 2018, there were 2.5 billion voice assistants worldwide, and one research firm expects that number to increase to 8.0 billion by 2023.[7]

In addition to thermostats and voice assistants, IoT can connect to so much more. IoT connects watches, lightbulbs, refrigerators, cars, and countless other consumer and enterprise items online. Businesses and manufacturers can use IoT sensors to track inventory or on machinery and robotics to make processes more reliable, improve efficiency and lower costs.[8] Large scale use of IoT will enable smart supply chains, smart energy, smart agriculture, and much more.

Thanks to increasingly inexpensive sensors and enhanced analytics, the spread of IoT is occurring at a dizzying pace.[9] There were 7 billion IoT devices installed as of 2018.[10] That number is expected to hit 31 billion by the end of 2020 and rise further to more than 75 billion devices by the end of 2025.[11] The International Data Corporation (IDC) projects that in 2025, most individuals will have at least 1 data interaction every 18 seconds in large part from IoT devices.[12]

The expansion of IoT will be accompanied by an exponential growth in data. According to IDC, global data generated by IoT devices could surge at a compound annual growth rate of 29 percent between 2018 and 2025.[13]

Specialized computer occupations will contribute towards the growth and application of IoT technology. Computer and information research scientists play an important role in advancing IoT tools, bringing them to the forefront of artificial intelligence and machine learning.[14] Software developers will also be needed to design the digital solutions and applications that will harness the immense amount of data companies can collect through IoT, making newly designed technology user-friendly. Perhaps most importantly, the massive quantity of data and sensitive information collected through IoT will need to be stored and properly protected, which will fuel demand for information security analysts.

Safeguarding data in an increasingly digitized economy

One consequence of our increasingly digitized society is the prevalence of electronic data. Sensitive personal data are now stored online by shops, government agencies, financial institutions, and even healthcare facilities. The

quantity of electronic data is expected to increase over the next decade in tandem with robust growth in the digital economy and greater cybersecurity will be needed to protect it and ward off the threat of breaches.

The frequency and complexity of hacks and security breaches have increased in step with our growing digital economy.[15] Hackers can deploy malicious software, capitalize on system vulnerabilities to infiltrate databases and networks, target individuals through scam emails or websites, and even hack into our mobile phones.

In 2019, businesses and institutions publicly disclosed 7,098 breaches, with 15.1 billion records compromised as a result, according to Risk Based Security.[16] 2019's number of breaches was an all-time high and the number of records exposed was a staggering 284 percent increase compared with the amount in 2018.[17] Moreover, the record number of breaches in 2019 marked a significant increase from the approximately 986 recorded breaches at the outset of the decade in 2010, when 103 million records were stolen.[18] The threat of data breaches is expected to intensify over the next decade as more consumer information is stored online and black market demand for such data sees no sign of decreasing.

As businesses and institutions across a wide range of industries continue to integrate applications and other digital tools into their services and operations, they will need to invest in cybersecurity infrastructure to prevent data breaches. According to one estimate, the global cybersecurity market is projected to grow 86 percent from around $145 billion in 2018 to $270 billion by 2026.[19]

Data breaches can be very expensive for companies to resolve. A report from the International Business Machines (IBM) Corporation and the Ponemon Institute estimated the average total cost of a data breach in the United States is over $8 million, including the indirect costs of loss of business and company reputational damage.[20] The total cost of a data breach can run up into the tens of millions of dollars depending on the severity of the breach, with several of the largest in 2019 topping $100 million.[21]

Information security analysts play a vital role in helping businesses secure their data and private information. According to labor market research by Burning Glass Technologies, demand for cybersecurity workers will be greatest in areas related to building secure digital infrastructure from the ground up.[22] The research firm sees the fastest cybersecurity job growth over the next 5 years in application development security, cloud security, and risk management.[23] The firm projects the largest employment increase to take place in health information security, stemming from a growing need for specialists in healthcare security, medical record security and confidentiality, and Health Insurance Portability and Accountability Act (HIPAA) regulation and compliance.[24] All in all, demand for information security analysts will remain high over the next decade as they will continue to be fundamental in ensuring IT protection for users, companies, and governments alike.

Conclusion

As consumers and businesses increasingly participate in the digital economy, connect devices to the internet, and store more sensitive data online, the demand for specialized computer occupations will increase notably. As a result, employment of information security analysts, software developers, and computer and information research scientists is expected to grow at a robust pace over the next decade from 2019 to 2029.

This **Beyond the Numbers** article was prepared by Alan Zilberman, an economist formerly in the Office of Employment of Unemployment Statistics, U.S. Bureau of Labor Statistics, and Lindsey Ice, an economist in the same office. E-mail: Ice.Lindsey@bls.gov; telephone: 202-691-5700.

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NOTES

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