COMPUTER ECONOMICS
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IT Salary Report 2021

Executive Summary

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About Computer Economics

Computer Economics, a service of Avasant Research, provides original research and metrics for the strategic and financial management of information technology. Our clients include IT end-user organizations, major consulting firms, and service providers in North America and around the world. Our *IT Spending and Staffing Benchmarks* study, published annually since 1990, is the definitive source for IT organization benchmarking data.

Other annual studies include *Technology Trends*, an assessment of technology adoption, spending, and economic experience; *IT Outsourcing Statistics*, which provides data on the use of and experience with IT outsourcing; *IT Management Best Practices*, which measure adoption trends of strategic IT practices; and *IT Staffing Ratios,* a series of benchmarking studies with metrics for 16 IT job functions.

In addition to these major studies, we publish IT management advisories on various issues of concern to IT managers. These reports are made available through our website. For further information on our custom benchmarking services, website subscriptions, advisory reports, and other services, please contact our office or visit our website at www.computereconomics.com.

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IT Salary Report 2021

Executive Summary

With the coronavirus pandemic defining a year of turmoil and change, many factors are buffeting IT salaries. For several years, we have been questioning why salaries for IT personnel were not growing at a faster pace. Even with business leaders asking more from IT personnel during this work-from-home (WFH) era, that slow-growth trend is continuing. In 2021, we foresee only modest upward pressure on IT wages. Overall, our *IT Salary Report 2021* anticipates that average wages for IT workers will rise 2.3%, lower than the 3% pace in the previous two years.

Moreover, there are few IT organizations raising wages more than the median 2.3%.

Moreover, there are few IT organizations raising wages more than the median 2.3%. For companies that responded to our survey, even those at the 75th percentile are budgeting for only a 3% raise. That is not significantly higher than the median and a sign that upward wage pressure generally remains low.

Hiring plans are also modest, with 47% of companies planning to increase IT head count. The upward pressure on salaries is just not there. As always, some in-demand jobs will see much higher increases in 2021.

Work From Home Here to Stay

In this year's salary survey, we focused several questions on one of the biggest business trends of the year: the massive shift to working from home in response to the pandemic. To get a handle on this, we asked respondents how much of their IT staff worked from home before the pandemic, during it, and what percentage they expect to work from home after the pandemic subsides. (Spoiler alert: There will definitely be more IT personnel working from home even after the pandemic is over.) We also asked respondents to indicate the extent to which they agree with five perceived advantages and five disadvantages of working from home and to give us their overall commentary on the matter.

Many survey respondents gave us an earful on the WFH issue. As with many issues in 2020, people have passionate views. One survey respondent wrote: "Pre-pandemic, our team would rotate WFH once to twice a week. This was well-balanced and did not impact productivity. Full-time WFH has been very disruptive and had a negative effect on the team." Another summed up the

WFH reality: "Our introverts are now happy and productive. Our extroverts … not so much."

Location-Based Salary Reductions

In addition to the work-from-home explosion, one of the biggest salary issues in 2020 and 2021 revolves around three things (as the old restaurant line goes): location, location, location. With so many working from home, should your salary be based on your location? For example, if a software developer moves from an expensive metro area such as San Francisco to a less-expensive locale in Nevada, Texas, Vermont, or Idaho, can a company pay her less? *Should* a company pay her less?

Even with the location-based-salary factor, the pandemic has increased the importance on the IT organization.

Some large tech employers this year have already said they will cut salaries to fit the location of the employee. Facebook CEO Mark Zuckerberg in particular was vocal about location-based salaries, saying his company will be "the most forward-leaning company on remote work at our scale."

Both sides of this location issue have arguments. Employers benefit by lowering their IT personnel costs, and although IT professionals may make less money in these areas, their salaries will stretch further. However, on the other side are more senior workers who refuse to make less, no matter where they live. One CEO wrote in a FastCompany article entitled, *Location-based salaries will kill your startup's culture*: "I pay my employees to work hard and do everything they can to make the company successful, not to live in a certain place. As long as an employee has proven they can be effective in a remote environment, their location shouldn't matter."

One possible accelerant to IT personnel moving to lower-cost regions is that many second or third-tier cities want to increase their populations and are trying to entice workers to make the jump. Cities including Tulsa, Okla., Topeka, Kan., and Savanna, Ga., are offering up to $15,000 to lure workers to their regions. Others are following suit, and it will be interesting to watch whether the location-based salary trend continues to put a damper on IT salaries in 2021.

Factors Buffeting IT Salaries in Both Directions

But other factors are pushing IT salaries in the other direction. For example, the pandemic has increased the importance of the IT organization. Any economic pressure to cut IT staffing levels appears to be more than offset by increasing demands for IT personnel to respond to the pandemic.

So why are salaries growing so modestly? Other factors are shaping this long-term trend, including:

- **Automation, cloud computing, and cutting infrastructure jobs:** Virtualization and cloud technologies are taking over internal data centers and, in many cases, eliminating them altogether. As a result, our research shows that infrastructure jobs are becoming less important, while business-facing skills are more in demand. This shift is making IT organizations more efficient and moderating the number of total new IT jobs. One of our survey respondents summed up this trend: "Those systems administrators, who specify, configure, and rack-and-stack servers are no longer needed. We still need sys admins, but this part of the function has gone away with SaaS and cloud hosting."

- **The business side limiting IT staff growth:** Even though the IT department is more vital during the pandemic and WFH, we see signs that business leaders are not allowing IT leaders to add as many new staff members as they would like. Our research is showing that business leaders are often choosing to pocket the savings they get from technologies such as the cloud, automation, and better collaboration and security tools. As a result, they are only giving the nod to modest increases in IT spending.

But even though IT salaries are rising modestly, some IT workers can expect greater than usual increases.

But even though IT salaries are rising modestly, some IT workers can expect greater than usual increases. Those in certain positions are receiving much greater pay raises than the 2.3% average increase. At the same time, pay in some positions is actually declining. To analyze what is going on and why, we took a deep dive into a few positions.

Salary increases that catch our eye include higher median pay for technical support analyst III and rises in all three help desk representative levels. We hypothesize that this is happening for several reasons, with the pandemic likely a significant factor here. Working from home is causing a massive demand for help desk and technical support. Hundreds of thousands of employees are working from home, some for the first time, with a natural increase in support incidents, such as dealing with home network configuration and VPN connections.

Furthermore, companies are using a greater variety of business applications, which puts increasing demands on the help desk. And, as we have been reporting, the more companies automate routine business processes, the more people skills matter, and the more experience matters. As a result, the help desk becomes the front line for the IT organization in showing its worth to the user community. This trend predates the pandemic, of course.

Moreover, help desk positions have been surprisingly challenging to fill for some companies. Geography plays a role here. If your company is in or near a

large metro area or large university, you likely have access to a wider variety of help desk candidates. Companies in small towns with less access to new grads have a hard time in this regard and have to offer help desk staff more money. Several respondents told us as much.

On the salary-declining side of the ledger, we continue to see a decrease in median salaries for information security analyst I, II, and III. This may seem counterintuitive, as cybersecurity is more important than ever. Here are some possible reasons:

This executive summary contains top-line findings from our salary survey.

- In recent years, security positions have experienced high demand and short supply. Until the past two years, wages rose, which drew more professionals into security. But now we are seeing more of a balance between supply and demand, which relieves wage pressure.

- There has been more security automation through artificial intelligence (AI) and machine learning. That has lessened the demand for lower-level, hands-on security professionals, in favor of tools that automate some processes. The lower-level tactical security job is being increasingly automated or subsumed into other positions such as network administrators, application programmers, and DevOps engineers.

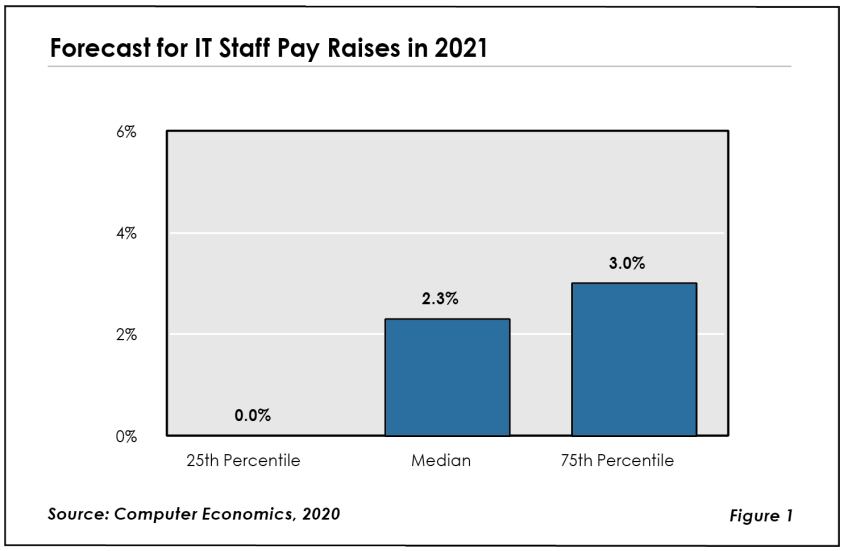
This executive summary contains top-line findings from our salary survey. Findings include the percentage of projected salary increases in 2021, expectations for head count changes, work-from-home levels before, during, and after the pandemic, and an analysis of the top advantages and disadvantages of working from home.

The full salary report estimates 2021 salaries for 80 IT job functions in more than 400 U.S. metropolitan areas and 20 sectors. The report is based on our annual salary survey of IT organizations in the U.S., along with other sources of compensation data as well as regional and industry data from the U.S. Bureau of Labor Statistics. For trend information, we also use our annual *IT Spending and Staffing Benchmarks* study and data from our year-end *Worldwide IT Spending and Staffing Outlook for 2021* study. A complete description of the methodology is provided at the end of this report.

Projected Pay Raises Remain Modest

Figure 1 shows that at the median, the typical IT worker will receive a 2.3% pay raise in 2021, a projection based on our salary survey. While even organizations at the 75th percentile are budgeting for only a 3.0% average raise—a sign that wage pressure generally remains low—the planned pay raises surpass the rate of inflation in the U.S., which is currently just 1.2%.

The typical IT worker will receive a 2.3% pay raise in 2021.



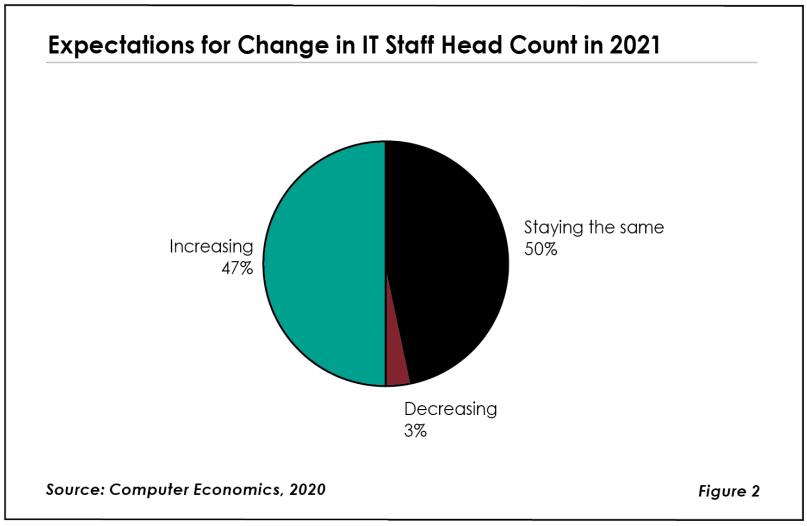
Source: Computer Economics, 2020

Figure 1

Half of IT Organizations Keeping IT Staff the Same

As shown in Figure 2, our survey finds that 47% of IT organizations anticipate increasing head count in 2021, which is much lower than the 58% in 2020. However, only 3% anticipate reductions in 2021. That is lower than the 5% that expected reductions in 2020. About 50% of IT organizations anticipate not adding to their IT head counts in 2021. Status quo seems to be the order of the day for most IT organizations.

However, only 3% anticipate reductions in 2021.



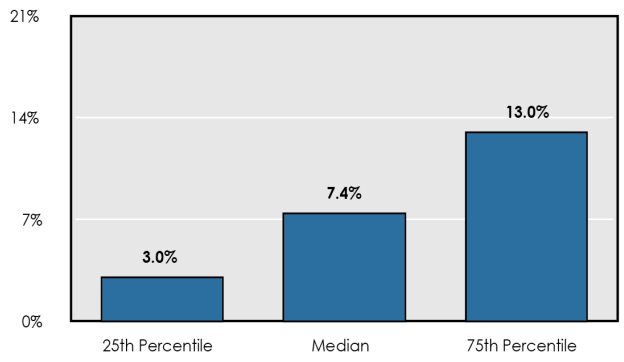
For Organizations Hiring, Median Head Count Growth Is 7.4%

The 2020 recession is having little effect, if any, on IT hiring plans.

In Figure 3, we analyze only those companies that will be increasing head count—eliminating those that will do no hiring or expect to cut personnel. This gives a better sense of how strong hiring is among those that are adding IT personnel. The median head count increase at those companies will be 7.4%. It falls to 3.0% at the 25th percentile and rises to a robust 13.0% at the 75th percentile.

Surprisingly, this median 7.4% increase is slightly ahead of last year's 7.0%, showing that the 2020 recession is having little effect, if any, on IT hiring plans.

Head Count Increases for Organizations Reporting an Increase



Source: Computer Economics, 2020

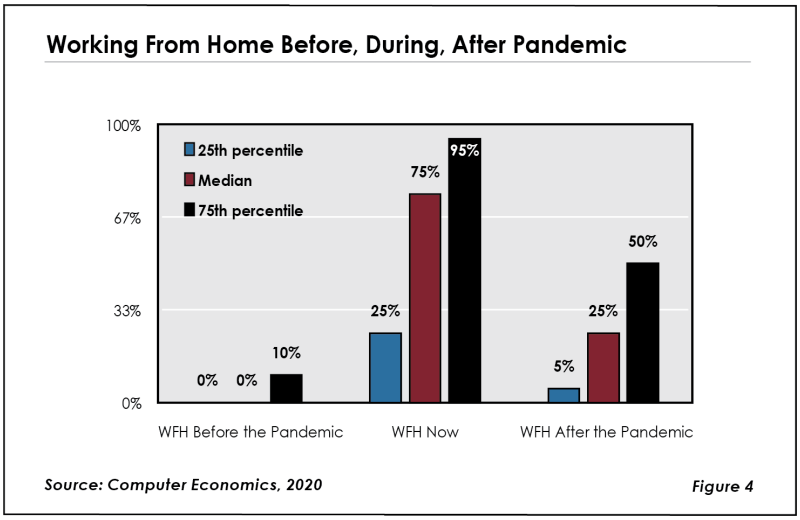
Figure 3

Working from Home Will Remain after Pandemic but at Lower Levels

Regardless of how long the pandemic lasts, one thing that appears to be here to stay is working from home, although the percentage will drop. Before the pandemic not many IT staff members were able to work fully from home. Some may have had the option to work from home, say, one day a week. But generally, most IT staff members had to spend the majority of their time in the office.

At the median, 75% of IT personnel are working full-time from home at the time of our survey, during the pandemic.

Figure 4 shows the trend. Before the pandemic, at the median, no IT personnel worked full-time from home. Then suddenly, overnight, the majority of IT workers switched to remote work in March and April, 2020. As shown in the figure, at the median, 75% of IT personnel are working full-time from home at the time of our survey, during the pandemic.



We also asked respondents to estimate the percentage of IT staff that they thought would work from home after the pandemic subsides. At the median, our respondents expect that 25% of IT personnel will be full-time home workers.

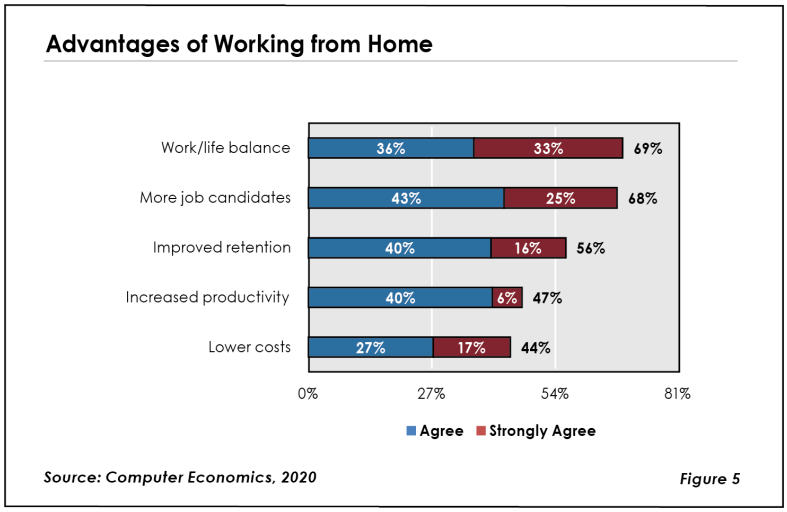
Earlier in the year, some companies told us they were already preparing for the long haul. A CIO of a government agency wrote, "We plan to have 100% of our IT staff working from home four days a week on average with shared offices in all of our buildings. This last part will most likely take a couple of years to put in place because of the investments required."

Better Work/Life Balance Is Top Perceived Benefit of WFH

We also asked survey respondents to indicate the extent to which they agreed with five advantages of working from home. For this question, we gave respondents a five-point scale, from strongly disagree to strongly agree. To more clearly present the findings, Figure 5 shows only the agree and strongly agree answers.

The second-highest perceived benefit—access to more job candidates—ranks higher than we may have expected.

The top perceived benefit, by a nose, is a better work/life balance. Thirty-six percent of respondents agree and 33% strongly agree that that is the top advantage of WFH. Close behind is the advantage of WFH policies giving companies access to a wider pool of job candidates, as employers can search from a wider geographic area. Forty-three percent agree with that advantage, and 25% strongly agree. The winner, a better work/life balance, is fairly intuitive and was much discussed in 2020.



Source: Computer Economics, 2020

Figure 5

The second-highest perceived benefit—access to more job candidates—ranks higher than we may have expected. For most of 2020, we did not think this was commonly understood. However, not all respondents can access far-flung, working-from-home job candidates. As one of our survey respondents stated, "Per policy, we cannot hire job candidates living full-time outside of the local area." Another wrote: "We still need the majority of our employees to be within the geographic location of their client for on-site support as needed."

Improved employee retention comes in third. Forty percent agree with that benefit, and 16% strongly agree. Regarding employee retention, one survey respondent had an interesting perspective: "I am neutral on employee retention, because I expect younger employees may be harder to retain if they cannot

become part of the culture. Perhaps a new culture will develop for the generation who works from home permanently."

Increased productivity places fourth. About 40% agree, and only 6% strongly agree with this perceived benefit. The fact that less than 50% agree or strongly agree apparently shows that many WFH staff members have at-home distractions. From pets demanding attention or children needing help with remote learning, some IT professionals find WFH a less-productive environment.

IT cost savings are a function of how aggressive a company is willing to be in its WFH policies.

In last place is lower costs. Twenty-seven percent agree, and 17% strongly agree with this perceived benefit of working from home. In other words, most respondents disagree with cost-savings as a benefit for WFH.

The fact is that IT cost savings are a function of how aggressive a company is willing to be in its WFH policies. If allowing more work from home does not allow a company to shrink its real estate footprint, then WFH won't help lower costs. In other words, if a firm is paying to house a lot of empty desks in an office that suddenly has an echo, then they are adding the costs of supporting the WFH force but not decreasing what they spend on rent and utilities. Another answer may be that, even when office space is diminished, whatever savings in office space that emerge may be offset by additional equipment costs.

But this might be a reflection of the limited cost savings that IT organizations can realize short term, while office leases are not yet up for renewal. One survey respondent said: "Eventually we could experience lower costs with more of the workforce working from home. Currently, leases, electricity, etc. all remain in place, and we have not experienced much of a reduction in costs." Another respondent wrote, "The only reason lower costs is not a 'strongly agree' for me is because of sunk investments in existing space. We can't just stop spend on that immediately."

Employees Feeling Less Connected Is Top Disadvantage

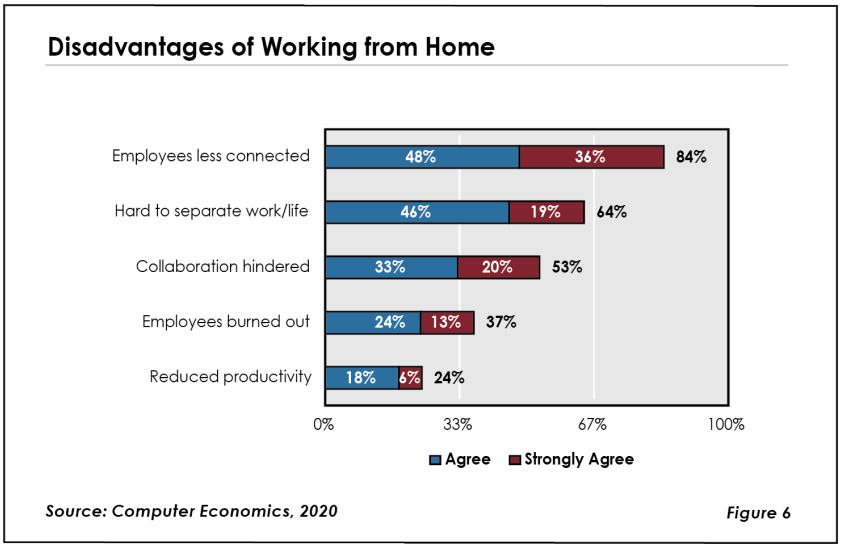
We also asked survey takers to indicate the extent to which they agreed with five disadvantages of working from home. As with the previous question, we gave respondents a five-point scale, from strongly disagree to strongly agree. Figure 6 shows only the agree and strongly agree answers.

Coming in third is the fact that employees are not able to collaborate as well.

The biggest disadvantage is that employees feel less connected. About 48% agree, and 36% strongly agree. Regarding the connection issue, one respondent wrote that his organization, "must be much more purposeful in meetings/check-ins so that the employee doesn't feel like he's on an island—especially if the culture was one of 'donuts in the breakroom.'"

The second-place perceived disadvantage of WFH is that employees find it hard to separate work life from home life. A respondent wrote, "Good work-life balance is more of a challenge when working from home, since there is no hard cut-off for determining when work stops and private begins, and vice versa."

Interestingly, in the previous section, the majority (69%) of respondents voted for "better work/life balance" as the top advantage. Now, here, the majority (64%) voted for "hard to separate work/life" as a disadvantage. It may be that it will take some time for IT organizations and IT workers to find a happy medium.



Coming in third is the perception that employees are not able to collaborate as well. About 33% agree, and 20% strongly agree that this is a problem. Many survey respondents weighed in on this topic. One respondent said: "Our ability to connect has not been hurt too badly due to effective collaboration tools."

Another stated, "We went through a two-month work-from-home period and found that ad hoc communication—and therefore effective collaboration—suffered."

Next on the list is WFH employees feeling burned out and overworked. About 24% agree, and 13% strongly agree. On the burnout issue, one respondent had this take: "Employees feel constantly tied to their work, with no natural breaks (i.e., leave the office, drive home). Clients perceive this situation as an opportunity to request assistance 24/7, which is a change from pre-COVID-19 expectations."

Last on the list is reduced productivity. About 18% agree, and only 6% strongly agree with this perceived disadvantage. The fact that only 24% agree or strongly agree with this shows that it is *not* perceived as a disadvantage. Once again, interestingly, in the previous question, the majority of respondents disagreed that working from home increased their productivity. Now, in this question, most disagreed that WFH reduced their productivity. The best explanation might be that in total, it does not have much impact on productivity, although it may be higher or lower for specific individuals, depending on their home situation, as noted earlier.

Contents of IT Salary Report

In our study, we project direct compensation (base pay plus incentive pay) for 80 IT job functions. For job titles not specifically covered, IT organizations should assess pay scales for functions with similar characteristics and at similar levels. A definition of all job titles in the study is included with this report.

The study estimates direct compensation for more than 400 metropolitan and nonmetropolitan areas, as defined by the Bureau of Labor Statistics. We also estimate direct compensation by industry. We report compensation as percentiles, including the 10th, 25th, 50th (median), 75th, and 90th. Note that data is not available for all job titles in every metropolitan area or at every percentile. Where there is insufficient data, we exclude the record or, for incomplete records, we use the abbreviation N/A (not available) for missing data.

We publish a salary table, *Computer Economics Salary Report 2021 Table*, in Excel format, which subscribers can download separately from the Computer Economics website.

Interpreting IT Salary Tables

The salary tables provide estimates for base salary plus incentive pay, also known as direct compensation. The estimates do not include benefits or employer-paid taxes, which can make up about 30% of the total cost of employment. Figure 8 shows the average cost of each component as a percentage of the total cost of employment for private sector and government employees, according to the Bureau of Labor Statistics.

Cost of Employment by Component

Compensation Component	Private Sector	Government
Wages and salaries	70.1%	68.6%
Paid leave	7.2%	7.2%
Supplemental pay	3.2%	2.8%
Insurance	8.0%	8.7%
Retirement and savings	3.8%	5.3%
Legally required costs	7.7%	7.4%
Total	**100%**	**100%**

Source: Bureau of Labor Statistics *Figure 7*

In this report, we provide a range of salaries for each job function in each locality. Each IT organization will need to decide where it should fall within this range based on size, sector, benefits, and other factors, as well as the specific attributes of each employee or prospective employee. The range is defined by the following percentiles:

- **The 10th percentile** represents the salary level at which 10% of organizations are paying median salaries at or below this level for a specific position.
- **The 25th percentile** represents the salary level at which 25% of organizations are paying median salaries at or below this level for a specific position.
- **The median** (50th percentile) represents the amount at which half the organizations are paying median salaries at or above this amount for a specific position.
- **The 75th percentile** represents the amount at which at least three-quarters of organizations are paying median salaries less than this amount, while the highest-paying 25% are paying at least the specified amount for a specific position.
- **The 90th percentile** represents the salary level at which 90% of organizations are paying median salaries at or below this level for a specific position. We do not provide estimates at the 90th percentile for all positions.

For some staff functions, we take into account the employee's level, which is based on a combination of experience, training, and specific job responsibilities. For staff functions such as help desk representatives, systems administrators, and technical support personnel, we provide salary ranges for Level 1, Level 2, and Level 3 positions. While each job function may have unique requirements for each level, in general, we define these levels as follows:

- **Level 1:** An entry-level or junior employee with one to three years of experience who requires supervision and works under the close direction of a senior-level employee.
- **Level 2:** An employee with three to five years of experience who works with minimal supervision and direction.
- **Level 3:** A senior employee with at least four to five years of experience who works independently and may supervise the work of others.

For some functions, we do not designate a level. In these cases, the salary range spans all levels and the median should approximate the median for all employees that perform the function, regardless of level. Organizations can approximate wages for lower-level employees by following the general rule that senior employees earn on average a little more than 120% of the median, while junior-level employees make a little less than 80% of the median. Our annual surveys show this range will vary by job function and geography, but the rule is nevertheless useful as a general guide.

Job Descriptions

The salary study provides information for 80 positions. To make it easier to search the data set, we place each position in one of six general classifications. These include IT management; data center operations; systems development; data management; Internet/networking/security; and technical services and other functions. For job functions not covered in this study, IT organizations should reference functions with closely related requirements in terms of experience, education, responsibility, and level.

The classifications and job descriptions for positions covered in this study are as follows:

IT Management

The IT management category includes the following job positions:

- **Chief Information Officer (CIO)**—The chief information officer is responsible for directing all of the information technology functions of the organization and establishing leadership for the IT department. The CIO ensures the IT organization's strategic goals and objectives are aligned with those of the enterprise and participates with executive management in establishing IT strategy for the enterprise. CIOs typically will have a bachelor's or master's degree in computer science or related subject area and at least 10 years of experience in an IT managerial role. The CIO usually reports to the company president or chief executive officer.

- **Chief Information Security Officer (CISO)**—The chief information security officer is responsible for determining, implementing, and enforcing all of an organization's information security standards, technologies, and procedures. The CISO gives executive guidance in the area of IT risk management. This individual will continually identify security threats and vulnerabilities in an organization's information systems, reassess the amount of risk present as well as the cost and value of implementing controls and preventative measures. The CISO will create new policies and implement systems changes where necessary. The CISO also is responsible for promoting security awareness in the organization and managing access privileges. The position requires a bachelor's degree and often requires an advanced degree in computer science or information systems. Ten or more years of experience in systems management is generally a requirement. The CISO typically reports to the CIO.

- **Chief Technology Officer (CTO)**—The chief technology officer provides leadership in evaluating and deciding on the technologies that the organization will deploy to carry out the organization's mission, vision, and business strategy. The CTO stays abreast of the latest technology and constantly evaluates them for potential application within the organization to give competitive advantage. He or she is also responsible for maintaining the road map for the development of new products and services that use information technology and plays a critical role in digital transformation of the enterprise. This position requires a bachelor's degree and may require an advanced degree in business or technology; 10 or more years of

experience in the IT field is generally a minimum requirement. The CTO typically reports to the CIO, CEO, or other top executive.

- **Vice President/Director, Information Technology**—The vice president/director of information technology is responsible for a regional or divisional information technology organization. This individual also functions as the ranking technologist in companies that do not have a CIO. The director of information technology is responsible for planning and directing the IT organization's strategic goals and objectives. This individual participates with corporate management in maintaining a close alignment of technology with the overall company business plan. The IT director approves and recommends hardware and software acquisitions and plays a major role in setting policies and procedures affecting information technology. This position requires a bachelor's degree and may require an advanced degree in business or technology; 10 or more years of experience in the information technology field is generally a minimum requirement. The IT director typically reports to the CIO or other top executive.

- **Director, Application Development**—The director of application development is responsible for all systems analysis and development functions under the control of the IT organization. This includes reviewing, planning, directing, and reporting on all systems development projects for each business unit. Significant knowledge of and experience in project management and systems development tools and techniques are required. This individual provides overall management and direction to all application development personnel and is a key executive member of the senior IT staff. This position requires a bachelor's degree in a related area and a minimum of 10 years of experience in the IT field, with at least six years in a management capacity. The director of application development typically reports to the CIO or vice president of IT.

- **Director, Enterprise Architecture**—The director of enterprise architecture establishes systems and application architecture for the entire organization. This individual is responsible for analyzing needs and overseeing improvement and development of the IT systems, as well as keeping track of updates and trends within the information technology market. The director of enterprise architecture also establishes communication within the organization necessary to carry out the task of implementing new architecture. This position requires a bachelor's degree and may require an advanced degree in computer science or information systems and 10 or more years of experience in the information technology field. The director of enterprise architecture typically reports to a top IT executive such as the CIO.

- **Manager, Application Development**—The manager of application development is responsible for directing systems analysis and development activities for one or more business units. This individual must have significant knowledge of and experience in project management and the design, coding, testing, debugging, and implementation phases of the application development process. The manager of application development must have formal training in software development languages and a thorough understanding of

application programming tools. This position requires a bachelor's degree in a related area and eight years of experience in the IT field, with at least six years in a systems analyst or programming capacity. The manager of application development typically reports to the director of application development or, in some organizations, may report directly to the CIO.

- **Manager, Data Center Operations**—The manager of data center operations is responsible for the ongoing management of the corporate data center environment. This individual ensures that production schedules are met and service levels maintained. The manager of data center operations establishes operational policies and procedures and is responsible for the physical security of all information and equipment housed in the data center. This position typically requires a bachelor's degree in a related area and at least eight years of experience in computer operations, with four years in a supervisory capacity. The manager of data center operations typically reports to the director of IT or, in some organizations, directly to the CIO.

- **Manager, Data Warehouse**—The data warehouse manager oversees a team responsible for designing, implementing, and supporting large-scale data warehouse systems. This individual coordinates the planning and design of the data warehouse and ensures that it meets business criteria. The data warehouse manager also is responsible for testing and upgrading the data warehouse as needed. The position usually requires a bachelor's or master's degree in a related area and at least four years of experience in data warehouse management. This position may report to the IT director, application development director, or CIO.

- **Manager, Database Administration**—The manager of database administration oversees a team responsible for designing, implementing, and maintaining an organization's database systems. This individual identifies ways to improve and update the database and ensures that the database interacts properly with the system and applications. The position typically requires a bachelor's degree in a related area and eight years of experience in the field of database design. The manager of database administration typically reports to the IT director.

- **Manager, Help Desk**—The help desk manager is responsible for the effective operation of the IT help desk environment. This individual manages personnel who provide Tier 1 support for all incoming IT issues, as well as working in a proactive manner to minimize potential problems before they become an issue. The help desk manager implements policies and procedures associated with the entire problem management life cycle, including identification, recording, receipting, documenting, corrective actions, and post-mortems. This individual must have a significant background in a variety of IT specialties. This position typically requires a bachelor's degree in a related area and at least six to eight years of experience in computer operations or another IT discipline, with four years in a supervisory capacity.

- **Manager, IT Procurement**—The manager of IT procurement is responsible for the acquisition of IT products and services. This individual works with project teams and senior

IT executives in sourcing vendors and service providers, developing requests for proposals, evaluating vendor proposals, negotiating contracts, and overseeing vendor performance. This individual also works closely with legal counsel when negotiating licensing and service provider contracts. This position typically requires a bachelor's degree and four to six years of experience in a senior IT staff or management capacity, professional procurement certification, and at least two years of procurement experience. The position usually reports to a senior IT director or the manager of IT finance.

- **Manager, IT Finance**—The IT finance manager assists senior management in the preparation and administration of IT budget and business plans. This individual ensures that all departments are adhering to specific budgets and business plans and reports on variances to senior management on a regular basis. The IT finance manager also may be responsible for reviewing, negotiating, writing, and administering vendor contracts, as well as interfacing with corporate finance and legal staff members. This position typically requires a bachelor's degree in accounting or finance and six to eight years of experience in a senior staff or management capacity in a large organization. Experience in a multiplatform IT environment also may be required. The manager of IT finance typically reports to a senior IT director.

- **Manager, Network Operations**—The network operations manager oversees a team responsible for daily network performance, upgrades and changes, and incident records. The network operations manager develops and implements standards, procedures, and processes for the network operations group and plans and manages support of new technologies. This individual also participates in strategic network planning, tactical operation planning, and the development of contingency operation plans. A bachelor's degree in a related field and four to eight years of experience in network operations is usually required. The network operations manager usually reports to a senior IT director.

- **Manager, Operating Systems Programming**—The manager of operating systems programming is responsible for the overall management of all production and test operating systems as well as all supporting systems utilities and tools. This individual reviews, approves, and directs any modifications to the OS environments. The systems programming manager also is responsible for directing all recovery efforts related to OS failures. This individual must be an expert in all aspects of managing complex OS environments. This position typically requires a bachelor's degree in a related area and eight years of experience in systems programming, with four years in a supervisory capacity. The operating systems programming manager typically reports to the director of IT operations or data center manager.

- **Manager, Telecommunications**—The manager of telecommunications is responsible for the ongoing management of voice, data, and video communications systems under the control of the organization. This individual reviews and approves all modifications to telecommunications systems and provides guidance and input on new technologies. The telecommunications manager must have significant knowledge and experience across a broad spectrum of telecommunications technologies and services. This position typically requires a bachelor's degree in a related area and eight years of experience in the IT field, with at least four years in a senior telecommunications analyst role. The telecommunications manager usually reports to a senior director. In some organizations, this individual may report directly to the CIO.

- **IT Auditor**—The IT auditor tests and evaluates IT systems for efficiency, accuracy, and security, provides verification of compliance with corporate policy and government regulations, and makes recommendations on improving systems and processes. IT auditors should be familiar with the organization's technology platforms, infrastructure, and architecture. They should possess strong communications and leadership skills. The position typically requires a bachelor's or master's degree in computer science or a related field and may require accreditation. The IT auditor reports to a senior auditor or senior IT manager or director.

- **IT Auditor, Senior**—The senior IT auditor plays a lead role in establishing audit controls to monitor information systems standards. This individual is responsible for the ongoing monitoring and reporting of audit information to senior IT management. The senior IT auditor also is responsible for analyzing audit information and providing recommendations for improvement. This position typically requires a bachelor's or master's degree in computer science or a related field and at least six years of experience in technical audits. The senior IT auditor typically reports to a senior IT manager or director.

Data Center Operations

The data center operations category includes the following job positions:

- **Cloud Architect**—The cloud architect is responsible for setting up and maintaining the infrastructure for public, private, and/or hybrid cloud environments. This individual establishes requirements for performance, monitors performance, and takes corrective action when service levels are not achieved. This position requires a strong understanding of cloud technologies and the various programming tools used to develop systems on them, including platform-as-a-service tools. It generally requires certification for one or more major cloud provider platforms such as Amazon, Microsoft, or Google and at least two years' experience working with them.

- **Computer Operator I**—The computer operator I assists senior personnel in the proper functioning of all production job streams, OS environments, hardware platforms, and peripherals. This individual monitors systems and peripherals and may participate in production job stream and system recovery efforts. The computer operator I must have working knowledge of a variety of data center OS environments and utilities. This position typically requires some coursework or technical training and one to two years of experience in the IT field.

- **Computer Operator II**—The computer operator II assists senior shift personnel in the proper functioning of all production job streams, OS environments, hardware platforms, and peripherals. This individual monitors and operates systems and peripherals and participates in production job stream and systems recovery efforts. The computer operator II must be knowledgeable in a variety of data center OS environments and utilities. This position typically requires coursework or technical training and at least three years of experience in the IT field.

- **Computer Operator III**—The computer operator III is responsible for the proper functioning of all production job streams, OS environments, hardware platforms, and peripherals. This individual monitors and operates systems and peripherals and plays a lead role in production job stream and systems recovery efforts. The computer operator III must be adept in a variety of data center OS environments and utilities and be capable of coordinating recovery efforts with personnel from various internal and external organizations. This individual may have training and supervisory responsibilities. This position typically requires significant coursework or technical training and at least six years of experience in the IT field.

- **Data Entry Clerk**—The data entry clerk is responsible for the accurate and timely input of source data into computer systems. This requires strong ten key and typing skills and the ability to understand complex end-user forms and data. The data entry clerk may have training and supervisory responsibilities. This position typically requires a high-school diploma and four years of experience in data entry or a related discipline. The data entry clerk usually reports to a supervisor in the data center operations group.

- **Disaster Recovery Administrator**—The disaster recovery administrator develops, implements, and maintains disaster recovery plans, policies, and procedures for IT systems. The main focus of the disaster recovery administrator is preparing to maintain business continuity in the wake of a disaster, by ensuring both the preservation of information and the ability to quickly recover and continue imperative business operations. This individual also assesses potential future risks and the value of planning to avoid them. The disaster recovery administrator typically needs a bachelor's degree in business or information systems and four to eight years of related work experience. This position reports to a senior IT director or sometimes the CIO.

- **Operating Systems Programmer I**—The operating systems programmer I assists senior personnel in the proper functioning of all operating systems, including all utilities and tools required to maintain the production and test environments. This individual also assists in the review of proposed modifications to the OS environments and participates in the testing and implementation of all changes. Under general direction, the operating systems programmer I provides technical support during recovery efforts involving failures related to the OS environments. This individual must have a good understanding of complex OS environments. This position typically requires an associate's degree in a related area and two to three years of experience in the IT field, with some formal training in systems programming. The operating systems programmer I usually reports to a lead operating systems programmer or the systems programming manager.

- **Operating Systems Programmer II**—The operating systems programmer II is responsible for the proper functioning of all operating systems, including all utilities and tools required to maintain the production and test environments. This individual will assist in the review of proposed modifications to the OS environments and will participate in the testing and implementation of all changes. The operating systems programmer II provides senior (Level 2 or 3) technical support during recovery efforts involving failures related to the OS environments. This individual must be adept in all aspects of managing complex OS environments. This position typically requires a bachelor's degree in a related area and four years of experience in the IT field, with at least three years in systems programming. The operating systems programmer II usually reports to the manager of systems programming or the data center manager.

- **Operating Systems Programmer III**— The operating systems programmer III is responsible for the proper functioning of all operating systems, including all utilities and tools required to maintain the production and test environments. This individual reviews all proposed modifications to the OS environments and leads the testing and implementation of all changes. The operating systems programmer III provides Level 3 technical support during recovery efforts involving failures related to the OS environments. This individual must be an expert in all aspects of managing complex OS environments and may have training and supervisory responsibilities. This position typically requires a bachelor's degree in a related area and eight years of experience in the IT field, with at least four to six years in systems programming. The operating systems programmer III usually reports to the systems programming manager or data center manager.

- **Systems Administrator**—The systems administrator is responsible for maintaining a variety of server and midrange system environments, including Windows Server, Unix, and/or Linux platforms. This individual installs and configures new OS environments and implements system upgrades and patches as required. The systems administrator participates in system recovery efforts and performs system backups and restorations. This individual must have strong working knowledge of a variety of server environments. This position typically requires a bachelor's degree and reports to a supervisor or manager.

- **Systems Administrator, Senior**—The systems administrator III, or senior systems administrator, is responsible for maintaining a variety of server and midrange system environments, including Windows Server, Unix, and/or Linux platforms. This individual installs and configures new OS environments and implements system upgrades and patches as required. The systems administrator III participates in system recovery efforts and performs system backups and restores. This individual must be an expert in all aspects of managing server environments and may have training and supervisory responsibilities. This position typically requires a bachelor's degree in a related area and eight years of experience in the IT field, with at least four to six years in systems administration. The systems administrator III usually reports to the systems programming manager or data center manager.

- **Systems Engineer I**—The systems engineer I is responsible for the development and maintenance of an organization's IT systems infrastructure. This individual designs hardware and software implementations as well as makes necessary updates to ensure system continuity. This position usually requires a bachelor's degree in computer science or a related field and zero to two years of experience in the field. The systems engineer I typically reports to a supervisor or manager within the IT department.

- **Systems Engineer II**— The systems engineer II is responsible for the development and maintenance of an organization's IT systems infrastructure. This individual designs hardware and software implementations as well as makes necessary updates to ensure system continuity. This position usually requires a bachelor's degree in computer science or a related field and two to four years of experience in the field. The systems engineer II typically reports to a supervisor or manager within the IT department.

- **Systems Engineer III**— The systems engineer III is responsible for the development and maintenance of an organization's IT systems infrastructure. This individual designs hardware and software implementations as well as makes necessary updates to ensure system continuity. This position usually requires a bachelor's degree in computer science or a related field and four to six years of experience in the field. The systems engineer III typically reports to a supervisor or manager within the IT department.

Application Development and Support Job Descriptions

The application development category comprises the following job positions:

- **Application Architect**—The application architect is responsible for ensuring that consistent and cost-effective technology and technical processes are developed and followed throughout the IT organization. This individual often participates in the design of new systems and may be required to approve new development projects from a technical standards perspective. This position requires a broad background in technology including hardware, software, networking, security, and planning. The application architect often will have responsibility for training and supervision. This position typically requires a bachelor's

degree in a related area and five to eight years of experience in the IT field, with four years in an application development position or similar technical job. The application architect usually reports to a director and may report directly to the CIO in smaller organizations.

- **Application Programmer I**—The application programmer I is responsible for assisting in the customization and development of applications under direct guidance from a senior programmer or manager. This individual assists in the design, coding, testing, debugging, and implementation phases of the application systems development process. The individual functioning in this capacity must have formal training in software development languages and techniques. This entry-level programming position requires at least an associate's degree in computer science or related area and will often require a bachelor's degree. One to two years of experience in the IT field is generally required as well. The application programmer I typically reports to a lead programmer or manager in the systems development group.

- **Application Programmer II**—The application programmer II is responsible for the customization and development of applications under general guidance from a senior programmer or manager. This individual must be proficient in the design, coding, testing, debugging, and implementation phases of the application systems development process. This position requires formal training in software development languages and techniques and typically requires a bachelor's degree in computer science or related area and four to seven years of experience in the IT field, with at least three years in a mainframe or midrange programming capacity. The application programmer II typically reports to a lead programmer or manager in the systems development group within the information systems department.

- **Application Programmer III**—The application programmer III is responsible for leading the development and customization of applications. This individual must be an expert in the design, coding, testing, debugging, and implementation phases of the application systems development process. This position requires formal training in software development languages and techniques and a bachelor's degree in computer science or related area and seven-plus years of experience in the IT field, with at least five years in a programming capacity. The application programmer III may be called upon to function as a team lead and may have ongoing supervisory responsibilities. The application programmer III typically reports to a systems development manager within the information systems department.

- **Mobile App Developer**—The mobile app developer specializes in the development and customization of mobile business applications. This individual is responsible for the design, coding, testing, debugging, and implementation phases of the mobile app development life cycle. In the cases where they are working on mobile versions of desktop applications, they must coordinate with the development team to maintain a smooth and consistent experience across all platforms. The individual functioning in this capacity must have formal training in software development languages used for both device-native apps as well as cross-platform development using tools such as HTML5. This position usually requires a bachelor's degree in computer science or prior mobile app developer experience.

- **Business Systems Analyst I**—The business systems analyst I is responsible for working directly with business unit personnel under direct supervision from a senior analyst or manager. The business systems analyst I assists in defining and establishing business and end-user requirements for existing and new application systems. This individual will develop a good working relationship with end-user organizations and assist senior business analysts in acting as the end users' representative on technology issues. The business systems analyst I must have good working knowledge of programming techniques and systems development life-cycle processes. Formal project management training is a plus. At a minimum, this position typically requires an associate's degree in computer science or a related field and two to three years of experience in the information technology field, preferably in a programming or technical support role. The business systems analyst I typically reports to a supervisor or manager within the systems development department or business systems analyst group.

- **Business Systems Analyst II**—The business systems analyst II works directly with business unit personnel under general guidance from a senior analyst or manager. The business systems analyst II plays a role in defining and establishing business and end-user requirements for existing and new application systems. This individual has a good working relationship with end-user organizations and will function as their representative on technology issues. The business systems analyst II must have strong working knowledge of programming techniques and systems development life-cycle processes. Formal project management training usually is required. At a minimum, this position typically requires a bachelor's degree in computer science or related field and three to five years of experience in the information technology field, with at least two years in a programming or a business analyst role. The business systems analyst II typically reports to a supervisor or manager within the systems development department or business systems analyst group.

- **Business Systems Analyst III**—The business systems analyst III works directly with business unit personnel with minimal guidance. This senior-level analyst plays a key role in establishing business and end-user requirements for existing and new application systems. This individual is responsible for developing strong working relationships with end-user organizations and will function as their lead representative on technology issues. The business systems analyst III must have a thorough understanding of programming techniques and systems development life-cycle processes. Formal project management training usually is required. At a minimum, this position requires a bachelor's degree in computer science or related field and five to seven years of experience in the information technology field, with at least four years in a programming or business analyst role. The business systems analyst III may perform supervisory functions and typically reports to a manager within the systems development department or business systems analyst group.

- **DevOps Engineer**—The DevOps engineer is responsible for establishing the software development and automated change management infrastructure for application development, automated testing, integration, and deployment that allows the organization to frequently or continually implement changes to production systems. A DevOps engineer bridges the worlds of application developers and IT operations and generally has expertise in both areas, along with technical knowledge of cloud infrastructure and services. Note that the DevOps engineer refers to individuals who implement and maintain the tools to support DevOps, not the software developers who merely use those tools. The DevOps engineer often reports to an IT executive within the applications group or in some cases to an IT operations executive.

- **Enterprise Resource Planning (ERP) Administrator**—The ERP administrator is responsible for administrative maintenance of the organization's ERP system, including maintaining user access rights, maintaining various system tables and parameters, setting up user reports and inquiries, monitoring ERP system performance, resolving exception messages, and other non-development administrative activities. The ERP administrator may also evaluate and coordinate user change requests and participate in acceptance testing for new releases of the system. The ERP administrator usually reports to a manager within the applications group or in some cases to a line-of-business manager.

- **Project Coordinator**—The project coordinator is responsible for providing a variety of support tasks to aid in managing projects. The coordinator, under the direction of the project manager, assists with the planning, scheduling, documenting, and communication of project activities. By handling these routine project tasks, the project coordination role allows the project manager to focus on higher-value activities. The project coordinator may be part of a project management office or may report to an application development manager or other IT manager.

- **Project Manager**—The project manager is responsible for developing plans and overseeing IT projects across a broad spectrum of disciplines. This individual sets deadlines, assigns responsibilities, and monitors progress of projects. This individual must possess excellent communication skills and make judgments based on experience. The project manager must have a well-rounded background in the IT field and stay abreast of new technologies, including new project management techniques and tools. This position typically requires a bachelor's degree and training in project management methodology. The project manager typically reports to an IT manager or senior project manager.

- **Quality Assurance Analyst**—The quality assurance analyst is responsible for quality assurance and testing. This individual uses creative problem-solving skills to develop methods for testing software and gathering data on testing procedures and efficiency. This position requires a bachelor's degree in computer science or a related field and two to four years of experience in software development. The quality assurance analyst normally reports to a manager within the software development department.

- **Scrum Master**—The scrum master serves as a coach to agile development teams. This individual is responsible for planning and estimating sprints, facilitating daily scrums, monitoring delivery, removing impediments to progress, and conducting retrospective meetings. This position requires strong interpersonal skills in dealing with internal team members as well as external project stakeholders. This position requires formal training in agile development and at least two years' experience as an agile team member. The scrum master typically reports to a manager of application development.

- **User-Interface (UI) Developer**—The UI developer works with software development teams to design and develop the front-end user interface, making systems intuitive, easy to understand, and visually appealing. This individual is skilled at creating storyboards, process flows, heat maps, and wireframes to communicate the intended UI design. The UI designer may also conduct focus groups or other means of testing the effectiveness of the UI design. This position requires creativity and design sensibilities as well as formal training in UI design. It generally reports to a manager of application development.

- **Web Administrator**—The web administrator is responsible for managing the organization's website. This individual is in charge of maintaining website performance, upgrading hardware and software, and collecting statistics relevant to website usage. This position usually requires a bachelor's degree and four years of experience in web management. The web administrator typically reports to a manager in the web and e-commerce department.

- **Web Designer**—The web designer is responsible for the layout, design, and construction of web pages and sites. This individual must be adept in web and graphic design and have a good understanding of web usage and customer preferences. The web designer must be an expert in the use of a variety of software tools and techniques related to web environments. This position typically requires coursework leading to a bachelor's degree in a related area.

- **Web Developer**—The web developer assists in designing, developing, and supporting web-based applications. These applications include systems developed solely for the web environment as well as development efforts designed to web-enable end-user applications. This individual also may assist in the creation and ongoing management of corporate websites and intranet communities. The web developer will have a thorough understanding of programming techniques and tools, web development, and systems management tools. This position typically requires a bachelor's degree in computer science or a related field.

- **Web Developer, Senior**—The senior web developer is responsible for designing, developing, and supporting web-based applications with minimal direction. These applications include systems developed solely for the web environment as well as development efforts designed to web-enable end-user applications. The senior web developer also may play a key role in the creation of corporate websites and intranet communities. The senior web developer will have expert-level understanding of programming techniques and tools, web development, and systems management tools. This position requires a bachelor's degree in computer science or a related field and five to seven

years of experience in programming, with at least five years in web development. The senior web developer may be called upon to function as a team lead and may have ongoing supervisory responsibilities. This position typically reports to a manager in the systems development department within the IT organization.

Data Management

The data management category includes the following job positions:

- **Data Scientist**—The data scientist combines mathematical skills, industry/domain knowledge, and experience with data modeling tools to extract knowledge and insights that enable business decisions. This individual uses tools and techniques that range from simple data aggregation to statistical analysis to complex data mining and even artificial intelligence. The data scientist typically works within a cross-functional team that includes business analysts and domain-specific experts within the business. This position typically requires an advanced degree in mathematics, computer science, or a related area. The data scientist generally reports to a senior executive or director within the data management group or may report into the business function that is primarily served.

- **Data Analyst**—The data analyst is responsible for developing methods related to data collection and analysis. This individual works with the business intelligence team to meet data needs and develop models. This position requires a bachelor's degree in computer science or a related field and two to four years of experience in data management. The data analyst usually reports to a manger within the data management group.

- **Senior Data Analyst**—The senior data analyst is responsible for collecting, organizing, and interpreting statistical information. Once the data is collected, the senior data analyst is responsible for forming conclusions about what it means and advising business leaders in their decisions. This position requires a bachelor's degree in computer science or a related field and at least four years of experience in data analysis. The senior data analyst typically reports to a manger within the data management group.

- **Data Architect**—The data architect is responsible for developing information architectures and complex data models and approves the modification and new implementation of database systems. This individual works closely with end users and IT development staff to ensure that new and existing data models and databases are consistent with approved data architecture standards. The data architect must have expert-level knowledge and experience in data modeling and database design. This position requires a bachelor's degree in a related area.

- **Database Analyst I**—The database analyst I is responsible for the management and maintenance of large-scale database environments under direct supervision from senior database personnel. This individual also assists in the design and implementation of database systems and may provide guidance on the selection of appropriate database software. The

database analyst I also assists in identifying data sources and the development of data flow diagrams and related documentation. This individual must have a good working knowledge of database management and programming techniques. At a minimum, this position requires an associate's degree in computer science or related area and may require a bachelor's degree. Two to three years of experience in the IT field is required as well. The database analyst I typically reports to a manager in the systems development department.

- **Database Analyst II**—The database analyst II is responsible for the management and maintenance of large-scale database environments under general direction from senior database personnel. This individual also aids in the design and implementation of database systems and in providing guidance on the selection of appropriate database software. The database analyst II also assists in identifying data sources and is responsible for the development of data flow diagrams and related documentation. This individual must have strong working knowledge of database management and programming techniques. At a minimum, this position requires an associate's degree in computer science or related area and often requires a bachelor's degree. Four to seven years of experience in the IT field is required as well, with at least three years in a database analyst role. The database analyst II typically reports to a manager in the systems development department.

- **Database Analyst III**—The database analyst III is responsible for the management and maintenance of large-scale database environments. This individual plays a lead role in the design and implementation of database systems and provides guidance on which database software is appropriate for specific applications. The database analyst III identifies data sources and oversees the creation of data flow diagrams and related documentation. This individual must have expert knowledge of database management and programming techniques. This position usually requires a bachelor's degree in computer science or a related area and seven to 10 years of experience in the IT field, with at least five years in a database analyst role. The database analyst III typically reports to a manager in the systems development department.

- **Database Administrator**—The database administrator is responsible for the design, implementation, and ongoing management of corporate database systems. This individual must have expert knowledge and experience in all aspects of database management, including advanced software design and management tools. The database administrator resolves performance issues and ensures data integrity. This person may have a bachelor's degree or advanced training and typically reports to a manager within data center operations.

- **E-Commerce Administrator**— The e-commerce administrator establishes and maintains the e-commerce side of web stores, the use of web application program interfaces (APIs), as well as other e-commerce capabilities, such as Electronic Data Interchange (EDI) systems. This individual is responsible for establishing electronic connections with new trading partners and resolving issues or exceptions with data transmissions. He or she also maintains interfaces between e-commerce systems and back-end systems, such as ERP, supply chain management, customer relationship management (CRM), and other systems. This individual is well-versed in the technical infrastructure and protocols required for e-commerce as well as the business meaning of the data transferred. This position requires a bachelor's degree in a related area and a minimum of four years of experience in the IT field.

Internet/Networking/Security

The Internet, networking, and security category includes the following job positions:

- **Information Security Analyst I**—The information security analyst I is responsible for maintaining or assisting in maintaining the security of networks and computer systems, including the protection of data from unauthorized use or access. This individual oversees the monitoring of various security systems and resolves security violations. This position typically requires a bachelor's degree in a related area.

- **Information Security Analyst II**—The information security analyst II is responsible for tasks designed to ensure security of an organization's systems. This individual develops controls to protect against unauthorized access, modification, or destruction and develops IT security standards and policies. A bachelor's degree in computer science or a related field is usually required, as well as two to four years of related experience.

- **Information Security Analyst III**—The information security analyst III is responsible for enterprise information security strategy, governance, and risk management. The information security analyst III must have advanced, expert knowledge of data, network, user access, and system security techniques and tools. This individual understands Internet architecture and firewall configuration to protect system security. He or she may also have responsibilities for training other individuals in security practices and may also have supervisory responsibilities. A bachelor's degree in computer science or a related field is usually required, as well as four to seven years of related experience.

- **Messaging Engineer**—The messaging engineer designs, implements, and helps maintain an organization's messaging systems. This individual provides maintenance, support, and enhancements to systems. The messaging engineer also monitors and analyzes the systems to ensure they are consistently running and provides troubleshooting and support to users within the company. A bachelor's degree in computer science or a related field is usually required, as well as four to six years of experience with messaging systems. The messaging engineer typically reports to the network operations or telecommunications manager.

- **Network Administrator I**—The network administrator I assists senior personnel in maintaining the corporate local- and wide-area networks. Under general direction, this individual installs and configures new network systems and implements network upgrades and software as required. The network administrator I participates in network system recovery efforts and assists security personnel in monitoring and reporting network access violations. This individual must be knowledgeable about managing complex network environments. This position typically requires coursework leading to a bachelor's degree in a related area and two to three years of experience in the IT field. The network administrator I usually reports to a lead network administrator or the telecommunications manager.

- **Network Administrator II**—The network administrator II is responsible for maintaining the corporate local- and wide-area networks. This individual installs and configures new network systems and implements network upgrades and software as required. The network administrator II participates in network system recovery efforts and assists security personnel in monitoring and reporting network access violations. This individual must be highly skilled in managing complex network environments. This position typically requires coursework leading to a bachelor's degree in a related area and four to six years of experience in the IT field, with at least two to three years in network administration.

- **Network Administrator III**—The network administrator III is responsible for maintaining the corporate local- and wide-area network environments. This individual installs and configures new network system components and implements network upgrades and software as required. The network administrator III participates in network system recovery efforts and assists security personnel in monitoring and reporting network access violations. This individual must be an expert in all aspects of managing complex network environments and may have training and supervisory responsibilities. This position typically requires a bachelor's degree in a related area and eight years of experience in the IT field, with at least four to six years in network administration.

- **Network Engineer**—The network engineer helps design, implement, and maintain enterprise voice and data communications networks. This individual designs and maintains secure, optimized, data and voice networks while also providing technical expertise and support to others. Job requirements include a bachelor's degree in computer science or electrical engineering. Certification may be required. This person typically reports to a supervisor or manager.

- **Telecommunications Analyst I**—The telecommunications analyst I assists senior personnel in maintaining, evaluating, and supporting corporate telecommunications environments, including data, voice, and video communications systems. This individual also helps in providing technical support during recovery efforts involving failures related to telecommunications. This individual must have working knowledge of a variety of telecommunications disciplines. This position typically requires coursework leading to an associate's degree or bachelor's degree in a related area and two to three years of experience

in the IT field, with at least one year in a technical support role. The telecommunications analyst I usually reports to a lead support analyst or telecommunications manager.

- **Telecommunications Analyst II**—The telecommunications analyst II is responsible for maintaining and supporting corporate telecommunications environments, including data, voice, and video communications systems. This individual provides Level 2 or 3 technical support during recovery efforts involving failures related to telecommunications. This individual must have good working knowledge of a variety of telecommunications disciplines. This position typically requires a bachelor's degree in a related area and four to six years of experience in the IT field, with at least three years in telecommunications. The telecommunications analyst II usually reports to the manager of telecommunications.

- **Telecommunications Analyst III**—The telecommunications analyst III is responsible for maintaining and supporting corporate telecommunications environments, including data, voice, and video communications systems. This individual provides Level 3 technical support during recovery efforts involving failures related to telecommunications. The telecommunications analyst III must have expert knowledge of a variety of telecommunications disciplines and may have training and supervisory responsibility. This position typically requires a bachelor's degree in a related area and eight years of experience in the IT field, with four to six years in telecommunications. The telecommunications analyst III usually reports to the manager or director of telecommunications.

Technical Services and Other Functions

The technical services and other functions category includes the following job positions:

- **Help Desk Representative I**—The help desk representative I assists senior help desk personnel in providing Level 1 support to users on a wide range of IT problems and issues. This requires good communication skills and the ability to take direction regarding incident resolution. This individual must have working knowledge of IT systems, processes, and terminology. This position typically requires some coursework in IT or one year of experience in the IT field. The help desk representative I usually reports to a supervisor within the technical services organization.

- **Help Desk Representative II**—The help desk representative II is responsible for providing Level 1 or 2 support to end users on a wide range of IT problems and issues. This requires strong communication skills and the ability to categorize, research, resolve, and, when required, escalate incidents to the appropriate support personnel. This individual must have working knowledge of IT systems, processes, and terminology. This position typically requires some coursework in IT and three to four years of experience in the IT field. The help desk representative II usually reports to a lead manager or supervisor within the technical services organization.

- **Help Desk Representative III**—The help desk representative III is responsible for providing Level 1 or 2 support to end users on a wide range of IT problems and issues. This position requires exceptional communication skills and the ability to categorize, research, resolve, and, when required, escalate incidents to the appropriate support personnel. The help desk representative III may have training and supervisory responsibilities. This individual must have a strong understanding of IT systems, processes, and terminology. This position typically requires significant coursework in IT and six years of experience in the IT field. The help desk representative III usually reports to a data center supervisor or manager.

- **PC Technician**—The PC technician is responsible for the maintenance and repair of computer systems within an organization. This individual troubleshoots and repairs software and hardware problems and performs necessary upgrades. This position usually requires a technical associate's degree and two to five years of experience in a related field. The PC technician typically reports to a project leader or manager within the technical services department.

- **IT Trainer**—The IT trainer develops and conducts technical training programs for IT staff members. This individual is responsible for the accurate and timely content of training curriculums and for establishing training objectives and certification requirements. Duties may include writing course outlines, text, and test materials. This individual also may be responsible for coordinating external training programs with vendors for IT and other departmental staff members. This position typically requires a bachelor's degree and at least four to six years of experience in a large, multiplatform IT environment. A background in training or teaching is a plus.

- **Technical Support Analyst I**—The technical support analyst I assists senior personnel in ensuring that all hardware platforms, operating systems, utilities, and related tools and devices are available to successfully maintain production schedules and service levels. This individual assists in analyzing and evaluating system malfunctions and takes appropriate action as directed. The technical support analyst I must have working knowledge of a variety of operating systems, hardware platforms, and technical disciplines. This position typically requires an associate's degree in a related field and two to three years of experience in the IT field.

- **Technical Support Analyst II**—The technical support analyst II assists in ensuring that all hardware platforms, operating systems, utilities, and devices are available to successfully maintain production schedules and service levels. This individual evaluates all system malfunctions and takes appropriate action. The technical support analyst II must have significant knowledge of a variety of operating systems, hardware platforms, and technical disciplines. This position typically requires a bachelor's degree in a related field and four to six years of experience in the IT field.

- **Technical Support Analyst III**—The technical support analyst III is responsible for ensuring that all hardware platforms, operating systems, utilities, and devices are available to successfully maintain service levels. This individual analyzes and evaluates all system malfunctions and takes appropriate action. The technical support analyst III may have training and supervisory responsibilities. This individual must have expert knowledge of a variety of operating systems, hardware platforms, and technical disciplines. This position typically requires a bachelor's degree in a related field and eight years of experience in the IT field.

- **Technical Writer**—The technical writer is responsible for assisting in the development of all programs, operations, and technical documentation for the IT organization. This requires the ability to translate complex technical information into user-friendly documentation. This individual must be adept in the use of a variety of documentation tools and management concepts. This position typically requires an associate's degree in a related area. A technical writer usually reports to a manager in the systems development or data center operations group

Methodology

Computer Economics has been publishing its IT salary data for more than two decades. The study begins with a survey we conduct each year, gathering data from more than 100 IT organizations on median salaries and bonuses paid to their IT staffs for positions under study. We then draw upon our survey data, historical data, and data from the Bureau of Labor Statistics. That data draws from state unemployment insurance records and is used to create a model of how location influences compensation. This statistical model projects salaries for specific IT functions. We also compare our findings against other available sources of IT salary data for validation purposes. Additional trend analysis is derived from our annual *IT Spending and Staffing Benchmarks* study and our annual *Technology Trends* survey.

The *Computer Economics IT Salary Report 2021 Table* is available in Excel format at the Computer Economics website.