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IBM computer photograph on the cover © Mark Richards. Courtesy of the Computer History Museum in Mountain View, Calif.
About the 2015 Salary Guide

Compensation may not be the only factor that determines your employees’ satisfaction on the job. But it’s certainly one of the most important elements when it comes to recruiting the best technology professionals and convincing them to stay on board.

It’s crucial to ensure the salaries you offer are competitive with those of other firms in your industry and geographic region. For that reason, every organization should benchmark its salaries periodically. To help businesses do just that, Robert Half Technology releases a Salary Guide every year, complete with the most up-to-date information and advice on starting compensation, workplace issues and the current hiring outlook.

We are pleased to present the 2015 Salary Guide, which forecasts compensation trends across a wide array of technology positions. Salaries reflect starting pay only and do not include bonuses and other forms of compensation. The information is based on the market observations of our Robert Half Technology staffing and recruiting professionals, and the thousands of interim and full-time placements we make each year, as well as our frequent surveys of CIOs and other IT professionals.

As you grow and build your workforce this year, we hope you’ll find the information in this guide useful. For more about compensation and staffing, please visit our Salary Center at rht.com/salary-center.
Hiring Trends and Retention Strategies

Mobile, Security and Big Data: Three Drivers for Technology Hiring in 2015

Employers are likely to have difficulty finding skilled talent for a range of technology roles in 2015, according to research by Robert Half Technology. Although 89 percent of technology executives reported being somewhat or very confident about their companies’ growth prospects, 61 percent said they are facing recruiting challenges.¹ According to the U.S. Department of Labor’s Bureau of Labor Statistics, the unemployment rate for many IT positions is significantly lower than the national average. The supply of highly skilled technology professionals is expected to remain below demand for the foreseeable future, especially as companies across all industries look for specialized talent in three main areas: mobile, security and big data. Employers’ focus on hiring for these specific areas is a direct reflection of current business trends. And two of these areas – mobile and big data – are core components of what International Data Corporation calls the “third platform” of computing, which is expected to accelerate the transformation of IT and is closely linked to the emerging Internet of Things.²

Hiring Trends and Retention Strategies

Mobile
Our increasingly mobile and application-centric world demands that companies connect in meaningful ways with clients, consumers and employees anytime, anywhere, through any device. More than 70 percent of organizations have implemented some type of mobile strategy, according to research by Robert Half Technology. As companies expand their mobile initiatives, the need for professionals who can develop applications for smartphones, tablets and other mobile devices will only increase.

Mobile applications developers are already in high demand – and, as was the case in 2014, can expect to see increases in starting compensation in the year ahead.

Security
Keeping data secure and protecting company servers and cloud applications from cyber threats is a priority for any modern business. Any company that has a website, engages in e-commerce or collects data needs IT security professionals. Trends such as cloud computing, bring your own device (BYOD), mobility and virtualization – technologies businesses must have if they are to remain competitive and innovative – are only making it more difficult for IT teams to stay on top of threats, intrusions and vulnerabilities.

Not surprisingly, data security analysts, systems security administrators, network security administrators, network security engineers and information systems security managers are all highly sought. Accordingly, these are positions for which many employers are prepared to offer higher salaries in 2015. Candidates with in-demand security certifications such as Certified Information Systems Security Professional (CISSP) can expect to earn even higher compensation.

Big Data
Many companies are only just launching big data initiatives, while others are well advanced in their efforts to transform raw data into actionable intelligence for business decision-making, strategy-setting and innovation. But regardless of where any organization stands in harnessing the potential of its ever-growing quantity of data, it needs skilled professionals who know how to retrieve, interpret, analyze and report on that data – which often must be gathered from disparate sources. Big data-related roles, including data architect, data modeler and data analyst/report writer, are in high demand. Skilled business intelligence analysts are particularly marketable in the current environment.

Retention: Know What Tech Professionals Want

Finding and hiring in-demand technology professionals is only half the battle for employers. Retention can be an even more difficult challenge, especially in a market where skilled candidates know they are in demand, are feeling more secure about their job prospects and are more willing to explore new employment opportunities. In fact, more than one-third of IT professionals surveyed by Robert Half Technology said they plan to search for a new technology job in the coming year.\(^4\)

Many organizations are focusing more on retention to avoid losing strong performers. They are offering creative incentives, from travel opportunities to on-site health services, along with generous compensation packages. However, perks like these aren’t the only incentives that can keep valued technology professionals from leaving. Candidates surveyed by Robert Half Technology who said they would be looking for a job in 2015 cited lack of advancement potential and the need for a new challenge as the top two primary motivations for moving on.\(^5\)

So, while employers may feel pressure to offer “wow” perks like many leading tech firms do, the following actions also can go a long way toward retaining in-demand IT talent:

- **Offer competitive compensation.** Pay always plays a large role in job satisfaction, so ensure what you offer is in line with, or even above, what competitors in your market are providing.
- **Develop programs that support career growth and work/life balance.** Provide a well-defined career path for technology professionals and create the type of work environment that will persuade them to stay, regardless of economic conditions.
- **Keep burnout under control.** High-tech does not have to equal high stress. Promote realistic workloads, bring in project professionals when full-time employees are at capacity, and tackle morale issues immediately to help prevent staff from feeling overloaded and unhappy.
- **Support a culture of innovation.** What’s the number-one reason many tech professionals prefer to work for a startup? Less structure, more innovation. That’s what more than one-third of IT workers surveyed by Robert Half Technology said.\(^6\) Minimizing bureaucracy can help; it was the top obstacle to innovation cited by 30 percent of respondents to the same survey.

\(^4\) [IT Worker Survey, Robert Half Technology, June 2014.](#)

\(^5\) Ibid.

\(^6\) Ibid.
### Hiring Trends and Retention Strategies

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical insurance</td>
<td>95%</td>
</tr>
<tr>
<td>Paid time off</td>
<td>92%</td>
</tr>
<tr>
<td>Dental insurance</td>
<td>89%</td>
</tr>
<tr>
<td>Life insurance</td>
<td>81%</td>
</tr>
<tr>
<td>Retirement benefits</td>
<td>75%</td>
</tr>
<tr>
<td>Flexible work hours</td>
<td>57%</td>
</tr>
<tr>
<td>Subsidized training or education</td>
<td>45%</td>
</tr>
<tr>
<td>Work-at-home options</td>
<td>35%</td>
</tr>
<tr>
<td>On-site cafeteria/subsidized food</td>
<td>35%</td>
</tr>
<tr>
<td>On-site perks, such as dry cleaning, fitness center, etc.</td>
<td>18%</td>
</tr>
<tr>
<td>Matching gifts to charitable organizations</td>
<td>15%</td>
</tr>
<tr>
<td>Subsidized transportation</td>
<td>10%</td>
</tr>
<tr>
<td>Mentoring programs</td>
<td>10%</td>
</tr>
</tbody>
</table>

**Source:** Robert Half Technology survey of more than 1,100 technology workers. Conducted in June 2014.
Robert Half Technology was founded in 1994 to give employers access to technology professionals with the specialized skills that were becoming increasingly essential to business operations. Today, the candidates we place in temporary and full-time roles are needed for much more than just “keeping the lights on” for their organizations. They are mission-critical to helping businesses compete, achieve strategic objectives and reach new heights of innovation.

At Robert Half Technology, we’re extreme believers in technical innovation and the remarkable things it can do. But we also know that behind every smart piece of software, every powerful processor and every brilliant line of code is an even more brilliant person. In other words, innovation starts with people. That’s the mantra we live by, and it’s served us well over the last two decades.

To celebrate our 20-year anniversary, our 2015 Salary Guide takes a look back at how – and how much – technology and the people and positions behind it have evolved over the past two decades.

For additional information on technology trends, please visit our blog at blog.rht.com, where you can find hiring and management advice, career resources and tech news.

**20 Years of Evolving Technology**

**Growth in IT Salaries**

<table>
<thead>
<tr>
<th>Role</th>
<th>1994</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software Engineer</td>
<td>$45,000 - $62,000</td>
<td>$96,000 - $147,250</td>
</tr>
<tr>
<td>Database Manager</td>
<td>$62,500 - $77,500</td>
<td>$112,250 - $160,250</td>
</tr>
</tbody>
</table>

Innovation starts with people.

On Jan. 11, 1994, leaders from industry, government and academia convened at UCLA for a “Superhighway Summit” to discuss both the implications and opportunities of the emerging Internet. At the summit, U.S. Vice President Al Gore famously called the Internet the “information superhighway.”

While attendees of the Superhighway Summit could sense the Internet was about to spark tremendous change in how organizations and people communicate and access information, they likely could not envision just how rapidly that change would come – and extend to all corners of the globe.

The Internet was new to the population at large, even though it was already being used by millions of people, predominantly in government and academia.

Tim Berners-Lee had invented the World Wide Web and introduced the first web browser in 1990. The Internet was growing at a rate of 2,300 percent per month – an eye-popping statistic that caught the attention, and imagination, of entrepreneur Jeff Bezos, who launched e-commerce site Amazon a year later.

The digital revolution was firmly under way in 1994, though only a small population was truly aware of it. But that was all about to change – fast. That year, the world was introduced to Internet portal Yahoo, and the dot-com bubble began to take shape. Microsoft released its beta for Windows 95, its first consumer-oriented operating system. JPEG brought images to the Web. HotWired created the first banner ad. Red Hat Linux was founded – and so, too, was Robert Half Technology.

“The Internet was growing at a rate of 2,300 percent annually – an eye-popping statistic that caught the attention, and imagination, of entrepreneur Jeff Bezos, who launched e-commerce site Amazon a year later.”

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The evolution of technology that has unfolded, and accelerated rapidly, since 1994 is staggering. Here are just a few of the innovations – along with hiring trends in the technology profession – that we’ve witnessed over the past 20 years.¹²

1999: Wiki, Java and Flash enter the lexicon, and blog soon will follow. Broadband brings us high-speed Internet. Personal digital assistants (PDAs) and digital handheld phones abound. Apple breaks new ground with its colorful clamshell-shaped iBook – the first computer sold with internal wireless networking. Google celebrates its first birthday. It seems like everyone is working at – or starting – a dot-com. Many of these businesses are burning through venture capital yet not turning a profit.

¹² All information for “Tech Positions in High Demand” is based on research from Robert Half Technology.
**2004:** The dot-com bubble is long burst. (By 2003, “nearly 5,000 Internet companies had either been acquired or shut down in a massive sector consolidation.”13) But social networking is rising: Myspace is poised to become the most-visited social networking site in the world. LinkedIn is six months old.

Harvard University student Mark Zuckerberg launches Facebook. The future for Microsoft development, the Microsoft .NET framework, emerges. Motorola markets its Razr as the first “fashion phone.”14 Who isn’t downloading MP3s from iTunes to Apple’s game-changing iPods?

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**2009:** Asynchronous JavaScript and XML help make Web 2.0 a reality. Multicore processors boost our computing power. Facebook becomes the largest social network in the world. We’re watching and posting videos on YouTube.

Apple is preparing to release its iPhone 3GS. Google’s Android mobile OS hits the scene. By year-end, there will be more than 18 million people tweeting on microblog service Twitter.

**2009: TECH POSITIONS IN HIGH DEMAND:**
- Web developers
- Programmer analysts
- Help desk professionals
2014: There are more than 1 billion websites.\(^\text{15}\) By the end of the year, there will be more than 1.7 billion smartphone users.\(^\text{16}\) We spend most of our mobile media time using apps like Candy Crush Saga and Instagram.\(^\text{17}\) There are 90 million users of iPads and other tablets in the United States alone.\(^\text{18}\) When we work – which is anywhere with a wireless connection – we teleconference and web conference and video chat with colleagues and customers around the globe. We’re using data visualization tools to extract value from our big data stores.\(^\text{19}\)

The wearable technology market is growing, and many of us wonder if one day soon we will actually wear Google Glass.\(^\text{20}\) Over the past two decades, we’ve moved from imagining what the Internet will bring to wondering how we were able to live or work without it. The technology advancements that have happened both directly and indirectly because of the Internet have created a world where communication, collaboration and innovation occur between organizations and people anywhere, anytime and all the time.

### 2014: TECH POSITIONS IN HIGH DEMAND:
- Mobile applications developers
- Software developers
- Business intelligence analysts

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\(^{15}\) “Total Number of Websites,” Internet Live Stats: http://www.internetlivestats.com/total-number-of-websites/.


So where can we expect the rapid advancement in technology we’ve seen over the past two decades to take us in the next 20 years? Here are just a few predictions from the experts:

By 2020, there will be 50 billion devices connected to the Internet.21

By 2025, “information sharing over the Internet will be so effortlessly interwoven into daily life that it will become invisible, flowing like electricity, often through machine intermediaries.”22

By 2029, the Turing test will be passed – “the moment at which a computer will exhibit intelligent behavior equivalent to, or indistinguishable from, that of a human.”23

By **2030**, “the average person in the U.S. will have 4.5 packages a week delivered with flying drones. They will travel 40 percent of the time in a driverless car, use a 3-D printer to print hyper-individualized meals, and will spend most of their leisure time on an activity that hasn’t been invented yet.”

And by **2035**, “the Web, as a single space largely made up of web pages accessed on computers, will be long gone ... we will be talking about the coming of quantum computing, which will take us beyond the world of binary.”

Of course, we can’t know for sure what disruptive technologies the next 20 years will bring or how the technology profession will evolve because of those changes. However, we are able to project the salaries for the coming year, which are included on the following pages, based on our research.

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## Technology Salaries - United States

<table>
<thead>
<tr>
<th>Job Title</th>
<th>2014</th>
<th>2015</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Administration</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chief Information Officer (CIO)</td>
<td>$153,000 - $246,750</td>
<td>$157,000 - $262,500</td>
<td>4.9%</td>
</tr>
<tr>
<td>Chief Technology Officer (CTO)</td>
<td>$132,250 - $205,750</td>
<td>$137,500 - $220,250</td>
<td>5.8%</td>
</tr>
<tr>
<td>Chief Security Officer (CSO)</td>
<td>$126,750 - $189,750</td>
<td>$134,250 - $204,750</td>
<td>7.1%</td>
</tr>
<tr>
<td>Vice President of Information Technology</td>
<td>$134,750 - $196,750</td>
<td>$138,000 - $210,250</td>
<td>5.1%</td>
</tr>
<tr>
<td>Technology Director</td>
<td>$113,500 - $165,000</td>
<td>$118,750 - $174,000</td>
<td>5.1%</td>
</tr>
<tr>
<td>Information Technology Manager</td>
<td>$ 99,000 - $142,250</td>
<td>$101,750 - $150,750</td>
<td>4.7%</td>
</tr>
<tr>
<td><strong>Applications Development (a)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manager</td>
<td>$100,500 - $142,250</td>
<td>$103,250 - $150,750</td>
<td>4.6%</td>
</tr>
<tr>
<td>Project Manager</td>
<td>$ 88,500 - $131,500</td>
<td>$ 91,250 - $139,250</td>
<td>4.8%</td>
</tr>
<tr>
<td>Systems Analyst</td>
<td>$ 76,250 - $108,750</td>
<td>$ 79,500 - $114,500</td>
<td>4.9%</td>
</tr>
<tr>
<td>Applications Architect</td>
<td>$109,750 - $148,750</td>
<td>$115,750 - $159,500</td>
<td>6.5%</td>
</tr>
<tr>
<td>Business Systems Analyst</td>
<td>$ 75,500 - $109,750</td>
<td>$ 79,250 - $116,500</td>
<td>5.7%</td>
</tr>
<tr>
<td>CRM Business Analyst</td>
<td>$ 80,000 - $109,000</td>
<td>$ 84,500 - $116,750</td>
<td>6.5%</td>
</tr>
<tr>
<td>CRM Technical Developer</td>
<td>$ 89,500 - $119,750</td>
<td>$ 93,500 - $129,250</td>
<td>6.5%</td>
</tr>
<tr>
<td>Developer/Programmer Analyst</td>
<td>$ 69,250 - $122,750</td>
<td>$ 74,250 - $129,000</td>
<td>5.9%</td>
</tr>
<tr>
<td>ERP Business Analyst</td>
<td>$ 83,750 - $115,250</td>
<td>$ 87,500 - $124,500</td>
<td>6.5%</td>
</tr>
<tr>
<td>ERP Technical/Functional Analyst</td>
<td>$ 90,000 - $125,000</td>
<td>$ 94,750 - $132,000</td>
<td>5.5%</td>
</tr>
<tr>
<td>ERP Technical Developer</td>
<td>$ 94,250 - $130,250</td>
<td>$ 99,750 - $136,750</td>
<td>5.3%</td>
</tr>
<tr>
<td>Lead Applications Developer</td>
<td>$ 99,750 - $137,750</td>
<td>$106,250 - $148,250</td>
<td>7.2%</td>
</tr>
<tr>
<td>Mobile Applications Developer</td>
<td>$100,000 - $144,000</td>
<td>$107,500 - $161,500</td>
<td>10.2%</td>
</tr>
<tr>
<td>Technical Writer</td>
<td>$ 53,000 - $ 83,500</td>
<td>$ 55,000 - $ 85,250</td>
<td>2.7%</td>
</tr>
</tbody>
</table>

(a) Add the percentage below, based on national averages, to IT salaries for the following skills:
- AJAX (Asynchronous JavaScript and XML) development skills ........................................ 6%
- Business Objects skills ......................................................... 7%
- C# development skills ......................................................... 9%
- C++ development skills ......................................................... 5%
- Hyperion skills ................................................................. 7%
- Java development skills ....................................................... 9%
- Java EE/J2EE development skills .......................................... 9%
- LAMP (Linux, Apache, MySQL and Perl/PHP/Python) skills ............ 8%
- .NET development skills ....................................................... 9%
- PHP development skills ......................................................... 9%
- SAP development skills ......................................................... 6%
- SharePoint skills ............................................................... 10%
# Technology Salaries - United States

<table>
<thead>
<tr>
<th>Job Title</th>
<th>2014</th>
<th>2015</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consulting &amp; Systems Integration</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Director</td>
<td>$113,750 - $169,500</td>
<td>$119,750 - $178,750</td>
<td>5.4%</td>
</tr>
<tr>
<td>Practice Manager</td>
<td>$113,500 - $155,750</td>
<td>$119,250 - $164,750</td>
<td>5.5%</td>
</tr>
<tr>
<td>Project Manager/Senior Consultant</td>
<td>$94,500 - $135,500</td>
<td>$98,750 - $144,250</td>
<td>5.7%</td>
</tr>
<tr>
<td>Staff Consultant</td>
<td>$73,750 - $102,750</td>
<td>$77,500 - $108,750</td>
<td>5.5%</td>
</tr>
<tr>
<td>Senior IT Auditor</td>
<td>$106,750 - $146,750</td>
<td>$111,750 - $155,500</td>
<td>5.4%</td>
</tr>
<tr>
<td>IT Auditor</td>
<td>$91,500 - $127,000</td>
<td>$94,500 - $134,500</td>
<td>4.8%</td>
</tr>
<tr>
<td><strong>Data/Database Administration (b)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Big Data Engineer</td>
<td>$110,250 - $152,750</td>
<td>$119,250 - $168,250</td>
<td>9.3%</td>
</tr>
<tr>
<td>Database Manager</td>
<td>$107,750 - $149,000</td>
<td>$112,250 - $160,250</td>
<td>6.1%</td>
</tr>
<tr>
<td>Database Developer</td>
<td>$92,000 - $134,500</td>
<td>$98,000 - $144,750</td>
<td>7.2%</td>
</tr>
<tr>
<td>Database Administrator</td>
<td>$87,500 - $126,000</td>
<td>$91,000 - $134,750</td>
<td>6.7%</td>
</tr>
<tr>
<td>Data Analyst/Report Writer</td>
<td>$67,750 - $101,000</td>
<td>$70,750 - $108,250</td>
<td>6.1%</td>
</tr>
<tr>
<td>Data Architect</td>
<td>$111,750 - $153,750</td>
<td>$119,750 - $164,750</td>
<td>7.2%</td>
</tr>
<tr>
<td>Data Modeler</td>
<td>$97,250 - $134,250</td>
<td>$101,750 - $145,250</td>
<td>6.7%</td>
</tr>
<tr>
<td>Data Warehouse Manager</td>
<td>$115,250 - $154,250</td>
<td>$119,750 - $163,000</td>
<td>4.9%</td>
</tr>
<tr>
<td>Data Warehouse Analyst</td>
<td>$99,000 - $133,750</td>
<td>$102,500 - $142,500</td>
<td>5.3%</td>
</tr>
<tr>
<td>Business Intelligence Analyst</td>
<td>$101,250 - $142,250</td>
<td>$108,500 - $153,000</td>
<td>7.4%</td>
</tr>
<tr>
<td>Electronic Data Interchange (EDI) Specialist</td>
<td>$72,250 - $102,250</td>
<td>$74,750 - $108,250</td>
<td>4.9%</td>
</tr>
<tr>
<td>Portal Administrator</td>
<td>$91,250 - $121,000</td>
<td>$92,750 - $127,250</td>
<td>3.7%</td>
</tr>
</tbody>
</table>

(b) Add the percentage below, based on national averages, to IT salaries for the following skills:
Microsoft SQL Server database skills ........ 10%
Oracle database skills........................ 7%
<table>
<thead>
<tr>
<th>Job Title</th>
<th>2014</th>
<th>2015</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality Assurance (QA) &amp; Testing (c)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QA Engineer – Manual</td>
<td>$ 60,750 - $ 83,750</td>
<td>$ 63,750 - $ 88,250</td>
<td>5.2%</td>
</tr>
<tr>
<td>QA Engineer – Automated</td>
<td>$ 72,000 - $ 99,000</td>
<td>$ 74,250 - $103,750</td>
<td>4.1%</td>
</tr>
<tr>
<td>QA/Testing Manager</td>
<td>$ 87,500 - $116,750</td>
<td>$ 90,000 - $122,500</td>
<td>4.0%</td>
</tr>
<tr>
<td>QA Associate/Analyst</td>
<td>$ 60,250 - $ 93,500</td>
<td>$ 62,000 - $ 97,500</td>
<td>3.7%</td>
</tr>
<tr>
<td>Web Development (d)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Senior Web Developer</td>
<td>$ 97,750 - $135,250</td>
<td>$104,500 - $144,250</td>
<td>6.8%</td>
</tr>
<tr>
<td>Web Developer</td>
<td>$ 70,000 - $113,500</td>
<td>$ 73,500 - $122,000</td>
<td>6.5%</td>
</tr>
<tr>
<td>Web Administrator</td>
<td>$ 63,500 - $ 95,750</td>
<td>$ 66,500 - $102,000</td>
<td>5.8%</td>
</tr>
<tr>
<td>Web Designer</td>
<td>$ 60,250 - $ 99,000</td>
<td>$ 64,000 - $105,500</td>
<td>6.4%</td>
</tr>
<tr>
<td>E-Commerce Analyst</td>
<td>$ 79,500 - $114,750</td>
<td>$ 84,250 - $121,500</td>
<td>5.9%</td>
</tr>
<tr>
<td>Networking/Telecommunications (e)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network Architect</td>
<td>$109,250 - $156,500</td>
<td>$115,000 - $165,250</td>
<td>5.5%</td>
</tr>
<tr>
<td>Network Manager</td>
<td>$ 94,000 - $130,000</td>
<td>$ 98,000 - $137,250</td>
<td>5.0%</td>
</tr>
<tr>
<td>Network Engineer</td>
<td>$ 86,250 - $124,250</td>
<td>$ 90,750 - $131,250</td>
<td>5.5%</td>
</tr>
<tr>
<td>Wireless Network Engineer</td>
<td>$ 91,500 - $125,250</td>
<td>$ 99,000 - $137,500</td>
<td>9.1%</td>
</tr>
<tr>
<td>Network Administrator</td>
<td>$ 66,750 - $ 99,000</td>
<td>$ 71,250 - $105,750</td>
<td>6.5%</td>
</tr>
<tr>
<td>Pre-Sales Engineer/Technical Engineer</td>
<td>$ 82,750 - $116,750</td>
<td>$ 86,250 - $125,750</td>
<td>6.3%</td>
</tr>
<tr>
<td>Telecommunications Manager</td>
<td>$ 82,250 - $111,750</td>
<td>$ 86,000 - $118,500</td>
<td>5.4%</td>
</tr>
<tr>
<td>Telecommunications Specialist</td>
<td>$ 56,500 - $ 85,750</td>
<td>$ 59,000 - $ 91,250</td>
<td>5.6%</td>
</tr>
<tr>
<td>Operations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manager</td>
<td>$ 64,250 - $ 89,250</td>
<td>$ 65,500 - $ 93,500</td>
<td>3.6%</td>
</tr>
<tr>
<td>Computer Operator</td>
<td>$ 33,750 - $ 46,500</td>
<td>$ 34,750 - $ 48,000</td>
<td>3.1%</td>
</tr>
<tr>
<td>Mainframe Systems Programmer</td>
<td>$ 59,000 - $ 82,000</td>
<td>$ 61,500 - $ 85,000</td>
<td>3.9%</td>
</tr>
</tbody>
</table>

(c) Add the percentage below, based on national averages, to IT salaries for the following skills:
- Performance testing (e.g., Mercury Interactive Tools) skills ......................... 5%
- AJAX (Asynchronous JavaScript and XML) development skills ......................... 6%
- ASP development skills ..................... 5%
- C# development skills ..................... 9%
- ColdFusion development skills ............. 4%
- Content management system (CMS) skills 7%
- DCOM/COM/ActiveX development skills 5%
- Java development skills ................. 9%
- Java EE/J2EE development skills .......... 9%
- LAMP (Linux, Apache, MySQL and Perl/PHP/Python) skills ....................... 8%
- .NET development skills ................... 9%
- PHP development skills .................... 9%
- SharePoint skills ........................ 10%
- Virtualization skills ..................... 10%
- Web services development skills .......... 8%

(d) Add the percentage below, based on national averages, to IT salaries for the following skills:
- Cisco network administration skills ......... 9%
- Linux/Unix administration skills .......... 9%
- Voice over Internet Protocol (VoIP) administration skills .......... 5%
- Windows 7 skills .......................... 5%
## Technology Salaries - United States

<table>
<thead>
<tr>
<th>Job Title</th>
<th>2014</th>
<th>2015</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Security (f)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Security Analyst</td>
<td>$100,500 - $137,250</td>
<td>$106,250 - $149,000</td>
<td>7.4%</td>
</tr>
<tr>
<td>Systems Security Administrator</td>
<td>$95,250 - $131,500</td>
<td>$100,000 - $140,250</td>
<td>6.0%</td>
</tr>
<tr>
<td>Network Security Administrator</td>
<td>$95,000 - $130,750</td>
<td>$99,250 - $138,500</td>
<td>5.3%</td>
</tr>
<tr>
<td>Network Security Engineer</td>
<td>$99,750 - $131,250</td>
<td>$105,000 - $141,500</td>
<td>6.7%</td>
</tr>
<tr>
<td>Information Systems Security Manager</td>
<td>$115,250 - $160,000</td>
<td>$122,250 - $171,250</td>
<td>6.6%</td>
</tr>
<tr>
<td><strong>Software Development (g)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product Manager</td>
<td>$99,250 - $136,000</td>
<td>$101,750 - $145,000</td>
<td>4.9%</td>
</tr>
<tr>
<td>Software Engineer</td>
<td>$89,750 - $137,250</td>
<td>$96,000 - $147,250</td>
<td>7.2%</td>
</tr>
<tr>
<td>Software Developer</td>
<td>$80,250 - $127,250</td>
<td>$85,500 - $136,250</td>
<td>6.9%</td>
</tr>
<tr>
<td><strong>Technical Services, Help Desk &amp; Technical Support (h)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manager</td>
<td>$76,500 - $109,000</td>
<td>$80,500 - $114,750</td>
<td>5.3%</td>
</tr>
<tr>
<td>Desktop Support Analyst</td>
<td>$49,750 - $73,000</td>
<td>$52,000 - $77,000</td>
<td>5.1%</td>
</tr>
<tr>
<td>Systems Administrator</td>
<td>$62,250 - $96,500</td>
<td>$65,750 - $100,500</td>
<td>4.7%</td>
</tr>
<tr>
<td>Systems Engineer</td>
<td>$76,750 - $111,250</td>
<td>$80,250 - $117,500</td>
<td>5.2%</td>
</tr>
<tr>
<td>Messaging Administrator</td>
<td>$68,500 - $99,750</td>
<td>$72,500 - $105,000</td>
<td>5.5%</td>
</tr>
<tr>
<td>Help Desk Tier 3</td>
<td>$53,000 - $68,500</td>
<td>$55,250 - $74,000</td>
<td>6.4%</td>
</tr>
<tr>
<td>Help Desk Tier 2</td>
<td>$42,000 - $54,500</td>
<td>$43,750 - $58,000</td>
<td>5.4%</td>
</tr>
<tr>
<td>Help Desk Tier 1</td>
<td>$33,000 - $44,250</td>
<td>$34,000 - $47,250</td>
<td>5.2%</td>
</tr>
<tr>
<td>Instructor/Trainer</td>
<td>$52,250 - $83,000</td>
<td>$54,250 - $87,250</td>
<td>4.6%</td>
</tr>
<tr>
<td>PC Technician</td>
<td>$32,250 - $47,500</td>
<td>$33,750 - $49,750</td>
<td>4.7%</td>
</tr>
<tr>
<td>Business Continuity Analyst</td>
<td>$87,750 - $125,000</td>
<td>$92,500 - $132,250</td>
<td>5.6%</td>
</tr>
</tbody>
</table>

(f) Add the percentage below, based on national averages, to IT salaries for the following skills:
- Certified Information Systems Security Professional (CISSP) ......................... 6%
- Check Point Firewall administration skills ........................................... 7%
- Cisco network administration skills .................................................. 9%
- Linux/Unix administration skills ..................................................... 9%

(g) Add the percentage below, based on national averages, to IT salaries for the following skills:
- ASP development skills ................................................................. 5%
- C# development skills ..................................................................... 9%
- C++ development skills ................................................................. 5%
- DCOM/COM/ActiveX development skills ............................................. 5%
- Java development skills ................................................................. 9%
- Java EE/J2EE development skills ..................................................... 9%
- .NET development skills ................................................................. 9%
- PHP development skills ................................................................. 9%
- Web services development skills ....................................................... 8%

(h) Add the percentage below, based on national averages, to IT salaries for the following skills:
- Basis administration skills .......................................................... 5%
- Cisco network administration skills ................................................ 9%
- HDI certifications ................................................................. 5%
- Linux/Unix administration skills ..................................................... 9%
- Virtualization skills ................................................................. 10%
- Windows 7 skills ................................................................. 5%
## Technology Salaries - Canada

<table>
<thead>
<tr>
<th>Job Title</th>
<th>2014</th>
<th>2015</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Administration</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chief Information Officer (CIO)</td>
<td>$150,500 - $224,250</td>
<td>$157,000 - $237,000</td>
<td>5.1%</td>
</tr>
<tr>
<td>Chief Technology Officer (CTO)</td>
<td>$138,250 - $198,500</td>
<td>$143,250 - $209,000</td>
<td>4.6%</td>
</tr>
<tr>
<td>Chief Security Officer (CSO)</td>
<td>$126,250 - $208,000</td>
<td>$138,000 - $219,750</td>
<td>7.0%</td>
</tr>
<tr>
<td>Vice President of Information Technology</td>
<td>$146,000 - $213,250</td>
<td>$151,000 - $225,000</td>
<td>4.7%</td>
</tr>
<tr>
<td>Technology Director</td>
<td>$110,500 - $139,250</td>
<td>$115,250 - $147,500</td>
<td>5.2%</td>
</tr>
<tr>
<td>Information Technology Manager</td>
<td>$104,750 - $137,250</td>
<td>$104,750 - $145,500</td>
<td>3.4%</td>
</tr>
<tr>
<td><strong>Applications Development (a)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manager</td>
<td>$106,250 - $140,000</td>
<td>$109,750 - $146,750</td>
<td>4.2%</td>
</tr>
<tr>
<td>Project Manager</td>
<td>$ 90,750 - $140,250</td>
<td>$ 95,250 - $147,250</td>
<td>5.0%</td>
</tr>
<tr>
<td>Systems Analyst</td>
<td>$ 77,250 - $104,500</td>
<td>$ 81,250 - $108,250</td>
<td>4.3%</td>
</tr>
<tr>
<td>Applications Architect</td>
<td>$103,750 - $136,250</td>
<td>$110,000 - $143,250</td>
<td>5.5%</td>
</tr>
<tr>
<td>Business Systems Analyst</td>
<td>$ 87,250 - $121,000</td>
<td>$ 90,750 - $125,000</td>
<td>3.6%</td>
</tr>
<tr>
<td>CRM Business Analyst</td>
<td>$ 85,500 - $106,000</td>
<td>$ 88,750 - $113,000</td>
<td>5.4%</td>
</tr>
<tr>
<td>CRM Technical Developer</td>
<td>$ 85,750 - $113,750</td>
<td>$ 89,250 - $119,250</td>
<td>4.9%</td>
</tr>
<tr>
<td>Developer/Programmer Analyst</td>
<td>$ 75,250 - $112,250</td>
<td>$ 79,250 - $119,250</td>
<td>5.9%</td>
</tr>
<tr>
<td>ERP Business Analyst</td>
<td>$ 90,500 - $119,000</td>
<td>$ 95,000 - $125,250</td>
<td>5.1%</td>
</tr>
<tr>
<td>ERP Technical/Functional Analyst</td>
<td>$ 94,250 - $135,500</td>
<td>$ 98,000 - $142,750</td>
<td>4.8%</td>
</tr>
<tr>
<td>ERP Technical Developer</td>
<td>$ 99,000 - $141,250</td>
<td>$102,500 - $145,000</td>
<td>3.0%</td>
</tr>
<tr>
<td>Lead Applications Developer</td>
<td>$ 92,000 - $127,500</td>
<td>$100,750 - $134,000</td>
<td>6.9%</td>
</tr>
<tr>
<td>Mobile Applications Developer</td>
<td>$ 85,000 - $120,500</td>
<td>$ 93,000 - $132,000</td>
<td>9.5%</td>
</tr>
<tr>
<td>Technical Writer</td>
<td>$ 50,500 - $ 79,500</td>
<td>$ 51,750 - $ 82,500</td>
<td>3.3%</td>
</tr>
</tbody>
</table>

(a) Add the percentage below, based on national averages, to IT salaries for the following skills:

- AJAX (Asynchronous JavaScript and XML) development skills ............................... 3%
- Business Objects skills .................................................................................. 5%
- C# development skills ...................................................................................... 8%
- C++ development skills ...................................................................................... 5%
- Hyperion skills .................................................................................................... 3%
- Java development skills ..................................................................................... 7%
- Java EE/J2EE development skills ........................................................................ 6%
- LAMP (Linux, Apache, MySQL and Perl/PHP/Python) skills ................................. 7%
- .NET development skills ..................................................................................... 8%
- PHP development skills ...................................................................................... 8%
- SAP development skills ...................................................................................... 6%
- SharePoint skills .................................................................................................. 10%

All salaries listed on Pages 19-22 are in Canadian dollars.
Technology Salaries - Canada

<table>
<thead>
<tr>
<th>Job Title</th>
<th>2014</th>
<th>2015</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consulting &amp; Systems Integration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Director</td>
<td>$115,250 - $151,750</td>
<td>$118,750 - $160,250</td>
<td>4.5%</td>
</tr>
<tr>
<td>Practice Manager</td>
<td>$ 99,500 - $144,750</td>
<td>$103,500 - $152,500</td>
<td>4.8%</td>
</tr>
<tr>
<td>Project Manager/Senior Consultant</td>
<td>$ 95,250 - $146,750</td>
<td>$ 99,250 - $149,000</td>
<td>2.6%</td>
</tr>
<tr>
<td>Staff Consultant</td>
<td>$ 60,500 - $ 83,500</td>
<td>$ 63,750 - $ 88,500</td>
<td>5.7%</td>
</tr>
<tr>
<td>Senior IT Auditor</td>
<td>$112,500 - $172,500</td>
<td>$114,000 - $175,000</td>
<td>1.4%</td>
</tr>
<tr>
<td>IT Auditor</td>
<td>$ 87,500 - $114,250</td>
<td>$ 90,750 - $117,000</td>
<td>3.0%</td>
</tr>
<tr>
<td>Data/Database Administration (b)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Big Data Engineer</td>
<td>$100,500 - $129,750</td>
<td>$109,000 - $139,250</td>
<td>7.8%</td>
</tr>
<tr>
<td>Database Manager</td>
<td>$102,000 - $136,500</td>
<td>$105,500 - $146,500</td>
<td>5.7%</td>
</tr>
<tr>
<td>Database Developer</td>
<td>$ 82,750 - $116,500</td>
<td>$ 90,250 - $120,750</td>
<td>5.9%</td>
</tr>
<tr>
<td>Database Administrator</td>
<td>$ 81,000 - $110,500</td>
<td>$ 85,000 - $115,500</td>
<td>4.7%</td>
</tr>
<tr>
<td>Data Analyst/Report Writer</td>
<td>$ 72,250 - $ 99,250</td>
<td>$ 74,500 - $104,000</td>
<td>4.1%</td>
</tr>
<tr>
<td>Data Architect</td>
<td>$104,000 - $142,000</td>
<td>$111,000 - $149,750</td>
<td>6.0%</td>
</tr>
<tr>
<td>Data Modeler</td>
<td>$ 85,750 - $116,750</td>
<td>$ 94,000 - $121,750</td>
<td>6.5%</td>
</tr>
<tr>
<td>Data Warehouse Manager</td>
<td>$ 99,250 - $133,750</td>
<td>$103,000 - $141,250</td>
<td>4.8%</td>
</tr>
<tr>
<td>Data Warehouse Analyst</td>
<td>$ 91,000 - $123,750</td>
<td>$ 95,000 - $131,000</td>
<td>5.2%</td>
</tr>
<tr>
<td>Business Intelligence Analyst</td>
<td>$ 81,750 - $113,750</td>
<td>$ 89,000 - $120,000</td>
<td>6.9%</td>
</tr>
<tr>
<td>Electronic Data Interchange (EDI) Specialist</td>
<td>$ 69,750 - $ 96,750</td>
<td>$ 73,750 - $101,500</td>
<td>5.3%</td>
</tr>
<tr>
<td>Portal Administrator</td>
<td>$ 71,500 - $ 97,250</td>
<td>$ 73,750 - $100,750</td>
<td>3.4%</td>
</tr>
</tbody>
</table>

(b) Add the percentage below, based on national averages, to IT salaries for the following skills:
Microsoft SQL Server database skills............ 9%
Oracle database skills............................ 7%
# Technology Salaries - Canada

<table>
<thead>
<tr>
<th>Job Title</th>
<th>2014</th>
<th>2015</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quality Assurance (QA) &amp; Testing (c)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QA Engineer – Manual</td>
<td>$64,500 - $90,750</td>
<td>$70,000 - $92,500</td>
<td>4.7%</td>
</tr>
<tr>
<td>QA Engineer – Automated</td>
<td>$69,750 - $96,500</td>
<td>$75,500 - $99,750</td>
<td>5.4%</td>
</tr>
<tr>
<td>QA/Testing Manager</td>
<td>$80,500 - $107,750</td>
<td>$84,750 - $109,750</td>
<td>3.3%</td>
</tr>
<tr>
<td>QA Associate/Analyst</td>
<td>$67,250 - $94,250</td>
<td>$69,750 - $94,750</td>
<td>1.9%</td>
</tr>
<tr>
<td><strong>Web Development (d)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Senior Web Developer</td>
<td>$89,750 - $116,000</td>
<td>$95,000 - $124,750</td>
<td>6.8%</td>
</tr>
<tr>
<td>Web Developer</td>
<td>$65,750 - $95,250</td>
<td>$69,000 - $102,750</td>
<td>6.7%</td>
</tr>
<tr>
<td>Web Administrator</td>
<td>$64,500 - $84,500</td>
<td>$67,500 - $89,750</td>
<td>5.5%</td>
</tr>
<tr>
<td>Web Designer</td>
<td>$69,000 - $95,250</td>
<td>$71,000 - $102,750</td>
<td>5.8%</td>
</tr>
<tr>
<td>E-Commerce Analyst</td>
<td>$69,750 - $100,250</td>
<td>$74,250 - $106,000</td>
<td>6.0%</td>
</tr>
<tr>
<td><strong>Networking/Telecommunications (e)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network Architect</td>
<td>$97,000 - $143,500</td>
<td>$101,250 - $152,000</td>
<td>5.3%</td>
</tr>
<tr>
<td>Network Manager</td>
<td>$83,750 - $109,750</td>
<td>$87,750 - $116,250</td>
<td>5.4%</td>
</tr>
<tr>
<td>Network Engineer</td>
<td>$84,750 - $111,250</td>
<td>$88,250 - $116,500</td>
<td>4.5%</td>
</tr>
<tr>
<td>Wireless Network Engineer</td>
<td>$90,750 - $116,500</td>
<td>$94,500 - $127,250</td>
<td>7.0%</td>
</tr>
<tr>
<td>Network Administrator</td>
<td>$67,250 - $88,250</td>
<td>$70,500 - $94,250</td>
<td>5.9%</td>
</tr>
<tr>
<td>Pre-Sales Engineer/Technical Engineer</td>
<td>$88,250 - $109,000</td>
<td>$92,000 - $117,750</td>
<td>6.3%</td>
</tr>
<tr>
<td>Telecommunications Manager</td>
<td>$89,500 - $115,250</td>
<td>$93,250 - $121,250</td>
<td>4.8%</td>
</tr>
<tr>
<td>Telecommunications Specialist</td>
<td>$63,000 - $87,750</td>
<td>$66,000 - $92,500</td>
<td>5.1%</td>
</tr>
<tr>
<td><strong>Operations</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manager</td>
<td>$77,500 - $92,250</td>
<td>$80,000 - $96,250</td>
<td>3.8%</td>
</tr>
<tr>
<td>Computer Operator</td>
<td>$42,500 - $53,500</td>
<td>$43,250 - $55,750</td>
<td>3.1%</td>
</tr>
<tr>
<td>Mainframe Systems Programmer</td>
<td>$63,500 - $88,500</td>
<td>$65,750 - $91,250</td>
<td>3.3%</td>
</tr>
</tbody>
</table>

(c) Add the percentage below, based on national averages, to IT salaries for the following skills:
- Performance testing (e.g., Mercury Interactive Tools) skills ......................... 4%
- AJAX (Asynchronous JavaScript and XML) development skills ......................... 3%
- ASP development skills ........................................ 4%
- C# development skills ...................................... 8%
- ColdFusion development skills .......... 4%
- Content management system (CMS) skills .......... 6%
- DCOM/COM/ActiveX development skills ........ 3%
- Java development skills .............. 7%
- Java EE/J2EE development skills ........ 6%
- LAMP (Linux, Apache, MySQL and Perl/PHP/Python) skills ............ 7%
- .NET development skills .................. 8%
- PHP development skills .................. 8%
- SharePoint skills .................. 10%
- Virtualization skills .................. 11%
- Web services development skills ........ 7%

(d) Add the percentage below, based on national averages, to IT salaries for the following skills:
- Cisco network administration skills .......... 9%
- Linux/Unix administration skills .......... 7%
- Voice over Internet Protocol (VoIP) administration skills .......... 5%
- Windows 7 skills .......... 5%
<table>
<thead>
<tr>
<th>Job Title</th>
<th>2014</th>
<th>2015</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Security (f)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Security Analyst</td>
<td>$ 93,000 - $139,000</td>
<td>$ 98,000 - $148,000</td>
<td>6.0%</td>
</tr>
<tr>
<td>Systems Security Administrator</td>
<td>$ 82,000 - $114,250</td>
<td>$ 87,000 - $120,000</td>
<td>5.5%</td>
</tr>
<tr>
<td>Network Security Administrator</td>
<td>$ 90,000 - $125,750</td>
<td>$ 94,500 - $130,000</td>
<td>4.1%</td>
</tr>
<tr>
<td>Network Security Engineer</td>
<td>$ 95,000 - $124,500</td>
<td>$ 99,750 - $133,750</td>
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<tr>
<td>Information Systems Security Manager</td>
<td>$ 104,250 - $136,250</td>
<td>$ 110,500 - $145,250</td>
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<tr>
<td><strong>Software Development (g)</strong></td>
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<td></td>
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<tr>
<td>Product Manager</td>
<td>$ 99,250 - $131,250</td>
<td>$105,250 - $139,750</td>
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<tr>
<td>Software Engineer</td>
<td>$ 85,500 - $123,250</td>
<td>$ 90,750 - $132,000</td>
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<tr>
<td>Software Developer</td>
<td>$ 68,000 - $113,500</td>
<td>$ 76,000 - $116,500</td>
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<td><strong>Technical Services, Help Desk &amp; Technical Support (h)</strong></td>
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<tr>
<td>Manager</td>
<td>$ 82,250 - $110,000</td>
<td>$ 86,250 - $116,000</td>
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<tr>
<td>Desktop Support Analyst</td>
<td>$ 55,000 - $ 75,500</td>
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<tr>
<td>Systems Administrator</td>
<td>$ 64,500 - $ 89,500</td>
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<tr>
<td>Systems Engineer</td>
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<td>Messaging Administrator</td>
<td>$ 67,000 - $ 84,500</td>
<td>$ 69,750 - $ 90,750</td>
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<td>Help Desk Tier 3</td>
<td>$ 63,500 - $ 82,750</td>
<td>$ 66,750 - $ 88,250</td>
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<tr>
<td>Help Desk Tier 2</td>
<td>$ 50,250 - $ 62,250</td>
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<tr>
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<tr>
<td>Instructor/Trainer</td>
<td>$ 55,250 - $ 76,000</td>
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<tr>
<td>PC Technician</td>
<td>$ 46,000 - $ 65,000</td>
<td>$ 48,000 - $ 67,250</td>
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<tr>
<td>Business Continuity Analyst</td>
<td>$ 75,500 - $108,000</td>
<td>$ 78,250 - $113,500</td>
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</table>

(f) Add the percentage below, based on national averages, to IT salaries for the following skills:
- Certified Information Systems Security Professional (CISSP) ............................. 6%
- Check Point Firewall administration skills ... 7%
- Cisco network administration skills ........... 9%
- Linux/Unix administration skills .......... 7%

(g) Add the percentage below, based on national averages, to IT salaries for the following skills:
- ASP development skills ........................... 4%
- C# development skills ........................... 8%
- C++ development skills ......................... 5%
- DCOM/COM/ActiveX development skills... 3%
- Java development skills ......................... 7%
- Java EE/J2EE development skills .......... 6%
- .NET development skills ......................... 8%
- PHP development skills .......................... 8%
- Web services development skills ............... 7%

(h) Add the percentage below, based on national averages, to IT salaries for the following skills:
- Basis administration skills ....................... 3%
- Cisco network administration skills ........... 9%
- HDI certifications ................................... 5%
- Linux/Unix administration skills .......... 7%
- Virtualization skills ............................ 11%
- Windows 7 skills ................................. 5%
Local Variances

### ALABAMA
- Birmingham ........ 95.0
- Huntsville .......... 93.0
- Mobile ............. 86.0

### ARIZONA
- Phoenix ........... 108.0
- Tucson ............ 102.0

### ARKANSAS
- Fayetteville ...... 95.0
- Little Rock ....... 95.0

### CALIFORNIA
- Fresno ............ 90.0
- Irvine ............. 124.5
- Los Angeles ...... 127.0
- Oakland .......... 127.0
- Ontario ........... 115.0
- Sacramento ...... 101.5
- San Diego ....... 118.5
- San Francisco .... 138.0
- San Jose .......... 135.0
- Santa Barbara ..... 125.0
- Santa Rosa ........ 118.1
- Stockton .......... 85.0

### COLORADO
- Boulder ........... 115.3
- Colorado Springs .. 90.5
- Denver ............ 103.7
- Fort Collins ........ 94.1
- Greeley ........... 84.6
- Loveland ........... 91.4
- Pueblo ............ 78.0

### CONNECTICUT
- Hartford ........... 116.5
- New Haven .......... 112.0
- Stamford ........... 131.0

### DELAWARE
- Wilmington ......... 105.0

### DISTRICT OF COLUMBIA
- Washington ........ 132.0

### FLORIDA
- Fort Myers .......... 89.0
- Jacksonville ...... 94.5
- Melbourne ........ 89.5
- Miami/
  - Fort Lauderdale . 107.0
  - Orlando ........... 99.0

The starting salary ranges provided on the previous pages reflect the national averages for each position. To determine the estimated salary range for a position in your area, use the local variance numbers on the following pages. Move the decimal point in the variance number two places to the left, then multiply this figure by the low and high ends of the salary range.

Source: U.S. Department of Labor’s Bureau of Labor Statistics and Robert Half Technology. City index figures are reflective of all industries and are not specific to the information technology field.

Note: Please contact a Robert Half Technology account executive for salary information regarding cities not listed in the guide.
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*Local Variances*
### Local Variances

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<tr>
<th>State</th>
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Source: U.S. Department of Labor’s Bureau of Labor Statistics and Robert Half Technology. City index figures are reflective of all industries and are not specific to the information technology field.

Note: Please contact a Robert Half Technology account executive for salary information regarding cities not listed in the guide.
Our glossary of job descriptions can help you better target the professionals you need. Use the descriptions on the following pages as a starting point and tailor them to match your specific requirements.

Administration

CHIEF INFORMATION OFFICER (CIO)
CIOs need broad knowledge of all aspects of IT. They must have strong analytical, strategic planning and communication skills. The ability to collaborate effectively with other senior managers in order to define, articulate and champion the ways in which technology requirements relate to the firm’s business is critical. A bachelor’s degree in computer science, information systems or a related area is expected, and a master’s degree is often required by employers. CIOs typically have at least 10 years of managerial experience in IT, though larger firms may require more.

Typical duties include:
• Developing and directing the firm’s overall IT strategy
• Working closely with other senior management, including the chief executive officer, chief technology officer, chief operations officer and chief financial officer, to coordinate data systems policies and procedures
• Providing vision and leadership in all aspects of IT management and operations
• Approving all major system hardware and software purchasing decisions

CHIEF TECHNOLOGY OFFICER (CTO)
CTO candidates require in-depth knowledge of all aspects of a firm’s data technology infrastructure. They also need tactical managerial skills to lead the IT department in attaining the company’s current and future technology goals. They typically have a degree in computer science or a related field and at least seven to 10 years of experience in IT management. In larger companies, the CTO may report to a chief information officer or a chief operating officer. Candidates need excellent interpersonal and problem-solving skills, as well as the ability to plan and execute projects within time and budget constraints.

Typical duties include:
• Setting the firm’s overall technology standards and practices
• Making recommendations, as well as explaining technology solutions, to senior management through presentations and advocacy
• Managing the implementation of data systems and monitoring their effectiveness in meeting business unit needs
• Providing leadership and managing a staff of direct reports in functional areas such as systems operations, LAN/WAN architecture, and hardware and software support

CHIEF SECURITY OFFICER (CSO)
CSOs need extensive experience in the field of information security, as well as in-depth knowledge of this rapidly evolving and critical business function. Employers look for a minimum of a bachelor’s degree in information systems or a related field, as well as 10 or more years’ experience with a focus on information security, compliance and privacy. The position requires excellent judgment and outstanding planning abilities in order to create and maintain complex security systems. Compliance- and security-related certifications are required.

Typical duties include:
• Managing enterprisewide security policies and systems
• Developing, implementing and monitoring long-term information security and privacy strategy
• Ensuring the firm meets all mandated security and compliance standards
• Coordinating work with all vendors, contractors and consultants to maintain and enhance data security
Glossary of Job Descriptions

VICE PRESIDENT OF INFORMATION TECHNOLOGY
The vice president of information technology position requires a proven track record of leadership in technology management, including excellent communication, analytical and organizational skills. A bachelor’s degree in computer science or a related field and five to 10 years of increasing responsibility are typical requirements for the job. Strategic planning and tactical implementation are important attributes for this position as well.
Typical duties include:
• Managing the tactical, overall operations of the IT department
• Working with the firm’s senior IT team to help plan and coordinate both short- and long-term systems strategy and implementation
• Serving as a liaison between nontechnical business units and IT, communicating technical information and plans
• Overseeing the department’s hiring, promotion and review processes

TECHNOLOGY DIRECTOR
Directors of technology are in charge of planning, organizing and executing technology functions, including leading, directing and managing a technology team. These professionals are responsible for the acquisition, operation, integration and problem-solving aspects of both hardware and software systems. Excellent communication and interpersonal skills are required, as well as an ability to identify and propose new IT business processes. Other desired characteristics include leadership, organizational, analytic and decision-making skills. Five to 10 years of experience and a bachelor’s degree in computer science or a related field are generally required. Project management certifications and/or a master’s degree in business administration are highly recommended.
Typical duties include:
• Developing the long-range direction of an organization’s technology function
• Creating and executing new technology strategies
• Hiring, training and reviewing IT staff
• Planning, directing and coordinating functions of a multiteam organization

INFORMATION TECHNOLOGY MANAGER
Information technology managers need a technical background, as well as business acumen and people management skills. Because they direct the work of other employees, these individuals require strong interpersonal and communication abilities. Analytical thinking also is very important, as this position often involves problem resolution and process development. In addition, a strong customer service orientation is a must because information technology managers often serve as the final escalation point for high-visibility troubleshooting. Employers look for a bachelor’s degree in an IT-related field, plus at least five years of experience with the specific types of business systems, hardware and networking services utilized by the firm. Demonstrated leadership also is required.
Typical duties include:
• Analyzing workflow, delegating projects and meeting departmental goals
• Developing and monitoring performance standards
• Providing input on hiring decisions for technical staff
• Implementing and monitoring new projects
• Managing performance of and delegating projects to team members

Applications Development MANAGER
Candidates seeking a manager of applications development position need a thorough technical background combined with outstanding managerial and leadership talents. They must have strong oral and written communication skills, project management experience, and proven abilities to facilitate multidisciplinary project teams in accomplishing strategic goals. Employers look for a bachelor’s degree in computer science, information systems, engineering or a related field. Depending on the size of the department, the company may seek five to 10 or more years of combined development and managerial experience.
Typical duties include:
• Assuming overall management responsibility for all aspects of the applications development department and its staff
• Planning, coordinating and monitoring the progress of development projects to ensure their ongoing alignment with business goals
• Hiring, training, motivating and evaluating staff
• Serving as a liaison to senior IT management, reporting on the status of current projects, identifying issues and assessing their impact, and proactively recommending solutions

PROJECT MANAGER
Project managers must have demonstrated knowledge and experience with project management methodologies in order to work with intricate, multifaceted projects. They need superb communication and interpersonal skills to collaborate with the development team and make project presentations. Employers look for a bachelor’s degree in an IT- or business-related field, as well as a background in applications development, and five or more years of experience managing complex projects. Project management certifications, such as those from Project Management Institute (PMI), also are highly recommended. Typical duties include:
• Managing overall coordination of IT applications development projects, from planning through implementation
• Setting project scope, priorities, deadlines and deliverable schedules
• Facilitating discussions and consensus among various project stakeholders, such as analysts, applications programmers and clients
• Managing and monitoring project budgets and expenditures

SYSTEMS ANALYST
Candidates for a systems analyst position must be excellent analytical thinkers and problem solvers, as well as effective communicators. They need a broad understanding of, and experience working with, hardware and software systems, including their installation, maintenance and life cycles. Employers look for a minimum of a bachelor’s degree in information systems, computer science or a similar field, along with five or more years of experience working with specific applications and/or operating systems. Typical duties include:
• Analyzing systems hardware and software problems and developing technical solutions
• Translating user and/or systems requirements into functional technical specifications
• Writing and maintaining detailed systems documentation, including user manuals and technical manuals
• Acting as a liaison between developers and end users to ensure technical compatibility and satisfaction

APPLICATIONS ARCHITECT
Applications architects require a high level of technical expertise combined with excellent planning, coordination and communication skills, as well as the ability to work on teams. Practitioners must have experience with relevant development tools and specific application and system architecture, in addition to a strong understanding of object-oriented design. A bachelor’s degree in computer science or information systems is normally required, and a master’s degree is highly desirable. Employers seek a minimum of five to eight years of related work experience and often look for software skill sets such as AJAX, C#/C++ and LAMP. Expertise in the design, development and deployment of enterprise-level N-tier architecture in a Microsoft .NET Framework or Java Enterprise Edition platform may be required. Typical duties include:
• Designing major aspects of the architecture of an application, including components such as user interface, middleware and infrastructure
• Providing technical leadership to the applications development team
• Performing design and code reviews
• Ensuring that uniform enterprise-wide application design standards are maintained
• Collaborating with other stakeholders to ensure architecture is aligned with business requirements

BUSINESS SYSTEMS ANALYST
Business systems analysts should have a solid understanding of business functional areas, business management issues and data analysis. Exceptional written and oral communication abilities are required. Leadership, initiative and advanced computer skills, including programming experience, also are integral. Employers often seek at least a bachelor’s degree and several years of computer applications and business experience. For more technically challenging positions involving complex business systems, a master’s degree with a concentration in information systems may be required.
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Typical duties include:
• Analyzing complex business problems and assessing how automated systems can be implemented to solve them
• Formulating and defining the objectives and scope of business systems
• Gathering data and analyzing business and user needs in consultation with both business managers and end users
• Providing IT support for regulatory and compliance activities
• Making recommendations on hardware and software procurement to support business goals

CUSTOMER RELATIONSHIP MANAGEMENT (CRM) BUSINESS ANALYST
Employers seek CRM business analysts with proven analytical and problem-solving capabilities, as well as extensive technical and functional experience with specific CRM systems. Because CRM business analysts serve as liaisons between IT and business groups, strong interpersonal and communication skills are essential. Employers also may require a demonstrated understanding of sales, marketing and other business processes. CRM business analysts must be able to anticipate the organizational impact of process changes. A bachelor’s degree in a computer-related field is typically required. Specific programming and technical requirements vary widely by position, but generally emphasize multiple years of development experience with the employer’s existing CRM solutions (e.g., Oracle, Microsoft, SAP). Typical duties include:
• Translating business requirements into user and functional requirements
• Conducting root cause analysis in support of process improvements
• Planning, conducting and directing the analysis of complex business issues to be solved with process changes and information systems
• Working closely with business users to resolve ongoing functional issues

CUSTOMER RELATIONSHIP MANAGEMENT (CRM) TECHNICAL DEVELOPER
Candidates for CRM technical developer positions must be able to work creatively and analytically in a problem-solving environment to develop, enhance and maintain CRM solutions. They also need strong interpersonal and communication skills in order to collaborate effectively with business analysts, developers and other stakeholders. A bachelor’s degree in a computer-related field is typically required. Specific programming and technical requirements vary widely by position, but generally emphasize multiple years of development experience with the employer’s existing CRM solutions (e.g., Oracle, Microsoft, SAP). Typical duties include:
• Programming and documenting CRM solutions
• Preparing code reviews and documenting development and testing
• Working with other IT teams to ensure that appropriate infrastructure, policies and procedures are in place to support the custom application environment
• Providing technical application support to business, quality assurance and end-user support teams

DEVELOPER/PROGRAMMER ANALYST
Developer/programmer analysts must have strong analytical and problem-solving abilities. They must understand and conceptualize applications from both a technical/programming perspective and a business point of view. Because they deal with both technical personnel and business managers/administrators, as well as participate on project teams, they need strong interpersonal and communication skills. Excellent programming abilities in common languages and frameworks, such as C#/C++, Java Enterprise Edition/AJAX and Microsoft .NET, are needed for the coding aspects of the position. Most employers look for at least a bachelor’s degree in computer science, information science or management information systems, as well as relevant job experience. Typical duties include:
• Analyzing business application requirements for functional areas such as finance, manufacturing, marketing or human resources
• Writing code, testing and debugging software applications
• Recommending system changes and enhancements
• Documenting software specifications and training users

Robert Half Technology 2015 Salary Guide | rht.com
ENTERPRISE RESOURCE PLANNING (ERP) BUSINESS ANALYST
For ERP business analyst positions, employers seek candidates with a demonstrated ability to translate business requirements into ERP solutions. Because ERP business analysts work closely with colleagues in technical and business departments, strong interpersonal and communication skills are essential. Project management experience also may be required. Specific technical requirements vary by employer, but strong technical and functional knowledge of the employer’s preferred ERP solutions is a must. Candidates also should have a thorough understanding of business processes, as well as an IT- or business-related bachelor’s degree.

Typical duties include:
• Analyzing and defining ERP systems, functions, business process and user needs
• Performing functional configuration and maintenance for ERP systems based on changing operational and business needs
• Researching transactional issues, identifying root causes and driving resolutions
• Creating documentation such as policies, procedures, workflows and user guides

ENTERPRISE RESOURCE PLANNING (ERP) TECHNICAL/FUNCTIONAL ANALYST
Candidates for ERP technical/functional analyst positions must be able to analyze complex processes, identify areas for improvement and recommend solutions. In addition to technical and functional ERP expertise, employers seek strong written and verbal communication skills and the ability to interact productively with business users. A bachelor’s degree in a computer-related field is typically required. Additional technical requirements vary by position but often include multiple years of experience working closely with the employer’s preferred ERP solutions.

Typical duties include:
• Completing technical service requests and providing continuous business application support for ERP software and legacy systems
• Helping to define, analyze, develop, implement and document new systems, customized programs and databases to meet business needs
• Helping to upgrade and implement ERP software
• Assisting application owners in the development of test scripts, policies and procedures

ENTERPRISE RESOURCE PLANNING (ERP) TECHNICAL DEVELOPER
ERP technical developers must be able to quickly identify and analyze technical problems in ERP applications, assess their potential impacts, and help design solutions. Employers typically seek candidates with experience implementing ERP systems over multiple life cycles, as well as the ability to work with business teams to support their requirements. A bachelor’s degree in a technical or business-related field, or equivalent experience, is generally required. Technical requirements vary but often include in-depth knowledge of the employer’s existing ERP solutions and related applications.

Typical duties include:
• Performing analysis, design, coding, data migration and testing for ERP production and development environments
• Implementing ERP enhancements to support changes in business processes
• Providing ERP application support
• Working with various business teams to gather requirements and support business processes

LEAD APPLICATIONS DEVELOPER
Candidates for lead applications developer positions need a solid background in applications programming and experience leading a technical team. Employers look for a bachelor’s degree in computer science or a related field, along with at least three years of experience in technologies such as .NET, PHP, C#/C++ and Microsoft .NET Framework development. In addition, individuals need several years of proven success as a team leader, as this role requires directing and motivating coworkers and working closely with other managers while multitasking and prioritizing resource needs.

Typical duties include:
• Leading a development team in the design, development, coding, testing and debugging of applications
• Coordinating the effective use of the development team’s time and ensuring efficient communication between team members and other IT functional areas

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• Providing feedback and suggestions for process and product improvement
• Acting as a technical mentor and adviser for the development team

MOBILE APPLICATIONS DEVELOPER
Mobile applications developers need strong analytical and problem-solving capabilities. Employers require previous experience building mobile applications and mobile websites for Android, iOS, Symbian, Windows Mobile or Windows Phone 7. Commonly specified languages and platforms include Java, Java EE, Java ME, JavaScript, JSON, Objective-C, .NET and HTML. A degree in computer science or computer engineering is typically required, though work samples of completed applications may soften that requirement. The combination of highly team-oriented work and short release cycles makes strong interpersonal and communication skills essential.

Typical duties include:
• Coding, testing, debugging, documenting and monitoring mobile applications
• Interacting with different departments within the organization regarding new deployments
• Contributing to the development of project schedules and workflow
• Recommending changes and enhancements to applications

TECHNICAL WRITER
Technical writers must possess the ability to communicate complex information clearly and concisely. They need excellent interpersonal skills in order to elicit detailed information from subject-matter experts (for example, applications developers), in addition to advanced writing and editing skills. Technical writers also need to be adept in document creation using applications such as Adobe FrameMaker, RoboHelp and Acrobat, and Microsoft Word and PowerPoint. Employers’ requirements vary depending on the complexity of documentation needed but usually include a bachelor’s degree in English, journalism or information sciences, plus several years of experience in a technical setting.

Typical duties include:
• Documenting the specifications, design, features and operation of applications
• Writing and editing user manuals, help systems and other technical documents
• Designing and formatting documents using document-creation software
• Interviewing applications developers and other technical resource personnel to ensure the accuracy of all information presented

Consulting & Systems Integration

DIRECTOR
A director-level position, typically found in a consulting services environment, is a senior-level management role. As a result, this position requires a seasoned professional with outstanding judgment, as well as leadership, interpersonal and communication skills. It also calls for strategic thinking, the use of decision-making authority and the assumption of formal responsibility for meeting business-unit goals. Candidates need strong project management experience and the ability to monitor and manage multiple initiatives concurrently, as well as excellent staff management skills. Employers often seek a master’s degree, such as an MBA, or other relevant graduate degree. In addition, 10 to 15 years of significant business experience, including leadership positions in consulting and project management, are typically required.

Typical duties include:
• Establishing and maintaining relations with clients’ senior-level managers
• Developing overall practice strategy, tactics and goals
• Managing the consulting staff, including headcount, final hiring and firing decisions, and staff development and mentoring
• Performing engagement analysis, and making recommendations and presentations to the consulting firm’s senior management on new business opportunities and expansion of the firm’s consulting practice and client base
• Working with third-party vendors

PRACTICE MANAGER
The practice manager position requires extensive IT experience combined with outstanding leadership, communication, presentation, customer service, analytical and project management skills. Individuals must possess excellent business and financial savvy, as well as experience with resource allocation and profit-and-loss

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management. At a minimum, a bachelor’s degree in business or an IT-related field is required, while an advanced degree may be preferred. Employers typically look for 10 years of IT industry experience with at least five years in a technical consulting management role. Candidates also must be willing to travel. Typical duties include:

- Developing project scope, goals and strategic plans for delivering company products and services to clients
- Managing, recruiting, evaluating and mentoring a team of project managers and consultants
- Managing and meeting engagement booking and revenue targets
- Identifying, developing and managing client relations, in addition to meeting with client management for project support and presentations
- Working with third-party vendors

**PROJECT MANAGER/SENIOR CONSULTANT**

Project managers/senior consultants need a combination of subject-matter expertise and project management skills. They must possess excellent communication, interpersonal and team leadership abilities, as well as the capacity to work with cross-functional teams to accomplish overall project goals. Employers seek at least a bachelor’s degree (a master’s may be preferred) in computer science, management or an IT-related discipline; specific consulting subject-matter expertise; and at least five years of experience managing projects from inception to completion. A project management certification is strongly preferred. Typical duties include:

- Developing and managing project specifications, technical design and requirements
- Setting project timelines, milestones and deadlines
- Coordinating work with cross-functional team leaders and monitoring and reporting on project status
- Assigning tasks to staff consultants and supervising work

**STAFF CONSULTANT**

Candidates for a staff consultant position need excellent analytical, problem-solving, customer relations and communication skills, along with the ability to work well in a team environment. They must have industry-specific expertise, as well as project-oriented IT experience. A minimum of a bachelor’s degree in computer science, business or a field related to the area of consulting is expected. Several years of business experience, plus two or more years of consulting experience – including full-cycle project implementation – also are typical requirements. Extensive travel may be required. Typical duties include:

- Assisting with project planning and requirement specifications
- Developing prototypes and alternatives in coordination with other team members
- Executing and delivering projects within time and budget constraints
- Understanding client needs and developing and maintaining excellent client relations

**SENIOR IT AUDITOR**

Senior IT auditors are responsible for developing and managing complex audits of an organization’s information systems. They must have in-depth knowledge of business processes, as well as process controls and risks, and understand how these relate to relevant IT audit procedures. These professionals have experience working with a variety of technology platforms and must be familiar with performing network, web, database and technical audits. These positions commonly require a bachelor’s degree (a master’s degree may be preferred) in computer science, information systems, business or a related field and an average of five years’ relevant experience in IT auditing. A Certified Information Systems Auditor (CISA), Certified Information Security Manager (CISM) or similar designation is strongly preferred. Typical duties include:

- Establishing objectives and procedures for audit review of computer systems
- Developing and implementing testing and evaluation plans for IT systems and controls to gauge conformity with industry standards of efficiency, accuracy and security
- Presenting written findings and recommendations to senior management
- Providing independent verification in connection with applicable U.S. Sarbanes-Oxley Act or Canadian Multilateral Instrument 52-109 compliance and similar regulations
IT AUDITOR
IT auditors must have broad knowledge of the technical infrastructure and architecture of computer systems, as well as exposure to a variety of platforms, such as operating systems, networks, databases and enterprise resource planning (ERP) systems. These professionals must possess excellent interpersonal skills, including communication, presentation and leadership abilities. Employers typically seek at least a bachelor’s degree (a master’s degree may be preferred) in computer science, information systems, business administration, finance or a similar field. A Certified Information Systems Auditor (CISA) accreditation also may be required.

Typical duties include:
• Testing and evaluating IT systems and controls for conformity with industry standards of efficiency, accuracy and security
• Providing independent verification of compliance with statutory requirements and similar regulations
• Making recommendations for systems operations and process improvements
• Developing risk-based audit plans

Data/Database Administration
BIG DATA ENGINEER
Big data engineers communicate with business users and data scientists to understand the business objectives and translate those objectives into data processing workflows. Big data engineers should have a strong knowledge of statistics and programming experience, ideally in Python or Java, as well as the ability to design and implement solutions for big data challenges. Knowledge and experience in data mining, processing large amounts of raw data, and designing and maintaining relational databases for storage and data acquisition are encouraged. Experience with NoSQL preferred. This individual communicates directly with business users and data scientists to understand objectives and create data processing workflows. Employers often require a bachelor’s degree in a related field and four to six years of experience.

Typical duties include:
• Gathering and processing raw data and translating analyses
• Evaluating new data sources for acquisition and integration
• Designing and implementing relational databases for storage and processing
• Working directly with engineering team to integrate data processing and business objectives

DATABASE MANAGER
Database managers must have an in-depth understanding of all aspects of database technology. Employers generally look for applicants with at least a bachelor’s degree and five years of experience in an Oracle, Microsoft SQL Server, IBM DB2 or similar environment, along with multiyear experience in a technical management position. Database managers need to be creative, analytical thinkers who can not only lead a team of database professionals but also effectively communicate, plan information system strategy and make presentations to senior IT managers.

Typical duties include:
• Maintaining and supporting a company’s database environment
• Providing input to a chief technology officer or chief information officer regarding company data standards and practices
• Developing and managing departmental budgets
• Making personnel decisions and work assignments
• Managing capacity planning, disaster recovery and performance analysis

DATABASE DEVELOPER
Database developers need a thorough understanding of relational database theory and practice. They must be analytical and adept at problem solving. They also should be good communicators. A bachelor’s degree in computer science or a related field often is sought, although database experience can be substituted.
with some employers. Familiarity and experience with major enterprise database programs, such as Microsoft SQL Server, Oracle or IBM DB2, are essential, and professional certification (Microsoft Certified Database Administrator or Oracle Database Administrator Certified Professional, for example) in these programs is a plus. Because many web applications now interface with databases, experience in Internet technologies also is valuable. Typical duties include:
• Developing database objects and structures for data storage, retrieval and reporting according to project specifications
• Implementing and testing database design and functionality, and tuning for performance
• Providing support to database administrators and interfacing with business users to ensure the database is satisfying business requirements
• Designing and developing back-end database interfaces to web and e-commerce applications

DATABASE ADMINISTRATOR
Candidates for the database administrator role need a strong technical foundation in database structure, configuration, installation and practice. Employers seek individuals with knowledge and experience in major relational database languages and applications, such as Microsoft SQL Server, Oracle and IBM DB2. At least two years of postsecondary education is typically required. Professional certifications from Microsoft, Oracle and others also are valuable. Effective database administrators must have keen attention to detail, a strong customer service orientation and the ability to work as part of a team. Typical duties include:
• Managing, monitoring and maintaining company databases
• Making requested changes, updates and modifications to database structure and data
• Ensuring database integrity, stability and system availability
• Maintaining database backup and recovery infrastructure

DATA ANALYST/REPORT WRITER
Strong analytical, quantitative and problem-solving abilities are required for this position, along with thorough knowledge of relational database theory and practice. Employers look for a bachelor’s degree in computer science, information systems or a related field, plus several years of experience working with major database platforms, such as Microsoft SQL Server, Oracle and IBM DB2. In addition, excellent communication skills and the ability to work both independently and collaboratively with data systems teams are required. Typical duties include:
• Analyzing complex data systems and documenting data elements, data flow, relationships and dependencies
• Developing automated and reusable routines for extracting requested information from database systems
• Compiling detailed reports using data reporting tools such as Crystal Reports, and making recommendations based on their findings
• Working in partnership with business analysts, data architects and database developers to build data transactional and warehousing systems

DATA ARCHITECT
Candidates for data architect positions require a high level of analytical and creative skills, along with in-depth knowledge of data systems and database methodology, design and modeling. They must be able to communicate effectively in order to plan and coordinate data resources. Working knowledge of network management, distributed databases and processing, application architecture, and performance management is highly valued. Employers generally seek a bachelor’s degree in computer science or a related field, as well as experience with Oracle, Microsoft SQL Server or other databases in various operating system environments, such as Unix, Linux, Solaris and Microsoft Windows. Typical duties include:
• Understanding and evaluating business requirements and translating them into specific database solutions
• Creating data design models, database architecture and data repository design
• Working with the systems and database administration staff to implement, coordinate and maintain enterprisewide data architecture
• Providing leadership in establishing and documenting data standards
• Creating and testing database prototypes
DATA MODELER
Data modelers must possess excellent data analysis and problem-solving skills, and be able to both communicate effectively and work as part of a team. Employers normally request a bachelor’s degree in computer science, IT or mathematics, in addition to several years of relevant data management experience. Candidates should be familiar with data modeling tools and methodologies and be knowledgeable in database system applications, stored procedures and data warehousing.

Typical duties include:
• Analyzing organizational data requirements and creating logical and physical models of data flow
• Interviewing key project stakeholders, documenting findings and making detailed recommendations
• Working with database administrators and reporting teams to ensure the availability of standard and ad hoc data reporting in a production environment
• Addressing data quality issues with clients and management

DATA WAREHOUSE MANAGER
The data warehouse manager role requires an in-depth background in database theory and practice combined with hands-on experience in data warehousing technology. Managers should have excellent analytical abilities, as well as project management experience. Proficiency in warehousing tools and architecture is a must, as is technical proficiency in database languages and applications such as Oracle, Microsoft SQL Server and IBM DB2. A bachelor’s degree in computer science or the equivalent, along with five or more years of experience in a data warehousing environment and three or more years in technical personnel management, are typical prerequisites. Typical duties include:
• Designing, developing and maintaining data warehouses and data mart systems
• Working with database developers, administrators and managers to ensure that data systems conform to enterprise data architecture and strategy
• Developing and implementing strategies for gathering data from operational databases and third-party vendors for inclusion in the warehouse
• Providing leadership in managing technical resources and staff

DATA WAREHOUSE ANALYST
Data warehouse analysts must have excellent research, analysis and problem-solving skills, as well as good oral and written communication abilities. A bachelor’s degree in computer science or a related field, along with extensive knowledge of relational database theory and three to five years of work experience in database systems, are typical prerequisites. Employers also seek candidates who possess experience with data modeling and architecture. A professional certification in a database application such as Microsoft SQL Server or Oracle also is valuable. Typical duties include:
• Collecting, analyzing, mining and leveraging data stored in data warehouses
• Researching and recommending technology solutions related to data storage, reporting, importing and other areas
• Working with business analysts to translate data requirements into logical data models
• Defining user interfaces for interacting with data warehouses and data marts

BUSINESS INTELLIGENCE ANALYST
Candidates for business intelligence analyst positions need a strong background in all aspects of database technology, with an emphasis on the use of analytical and reporting tools. Employers seek a bachelor’s degree in computer science, information systems or engineering, as well as several years of experience with database queries, stored procedure writing, Online Analytical Processing (OLAP) and data cube technology. Excellent written and oral communication skills are a must. Typical duties include:
• Designing and developing enterprisewide data analysis and reporting solutions
• Reviewing and analyzing data from multiple internal and external sources
• Communicating analysis results and making recommendations to senior management
• Developing data cleansing rules

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**ELECTRONIC DATA INTERCHANGE (EDI) SPECIALIST**

EDI specialists should have a solid background in information systems technology and working knowledge of data communication protocols. They must be detail-oriented, have excellent problem-solving skills and have the ability to work independently. A bachelor’s degree in computer science or a related discipline is normally required. In addition, employers typically look for several years of IT-related experience, plus three or more years with EDI systems administration, design, analysis and development.

Typical duties include:

- Implementing and monitoring EDI systems, including data mapping, translation and interface
- Coordinating relations with and serving as a liaison to internal users, vendors and other external partners with respect to data interchange standards
- Performing system testing and quality control checks
- Developing and maintaining EDI documentation

**PORTAL ADMINISTRATOR**

Portal administrators must have the ability to analyze and solve complex problems, as well as extensive knowledge of enterprise web applications, services, systems and supporting technologies. Portal administrators may interact with a wide range of technical and nontechnical colleagues, so candidates should have excellent written and verbal communication skills. Three to five years of systems administration experience may be required. Many portal administrator positions require experience installing and configuring IBM WebSphere Application Server and related products.

Typical duties include:

- Integrating functional requirements into portal applications development
- Managing user access to portal resources
- Deploying and managing portlet applications
- Ensuring reliability and availability of enterprise web environments

**Quality Assurance (QA) & Testing**

**QA ENGINEER - MANUAL**

Manual QA engineers define the scope and objectives of various levels of QA testing. They also write and maintain test automation, publish test results, develop quality assurance standards, and define and track quality assurance metrics. Manual quality assurance engineers should be highly knowledgeable in quality assurance principles and procedures and able to define, write and maintain test automation. They must have effective communication skills to translate technical processes and analytic techniques to solve problems, and be familiar with the materials used to build a product. Employers often require a bachelor’s degree in engineering and may seek candidates with experience in a particular industry.

Typical duties include:

- Defining the scope and objectives of various levels of QA testing
- Identifying defective products and areas that require improvement
- Writing, maintaining and publishing product specifications and test results
- Developing quality assurance standards and defining and tracking QA metrics

**QA ENGINEER - AUTOMATED**

Automated quality assurance engineers develop and execute automated testing suites. They also lead quality assurance efforts within a software development group and work closely with development teams and stakeholders performing QA activities. These professionals lead QA efforts through defining, developing, executing and documenting automated test plans and cases. Employers look for extensive knowledge in at least one automated testing framework. In addition, these workers must have experience performing usability testing and a strong understanding of the software development life cycle. The position frequently requires a bachelor’s degree in engineering or a related technical field, or at least three years of industry experience in software quality assurance, including automated testing and/or software development.

Typical duties include:

- Leading quality assurance efforts within a software development group
- Working closely with development teams and stakeholders performing QA activities
• Testing high-volume web-based applications
• Defining, developing, executing and docu-
menting automated test plans and test cases
• Developing automated test scripts with a variety
of testing tools

QA/TESTING MANAGER
QA/testing managers have an extensive
background in assurance methodologies and
procedures, along with excellent written and
oral communication, problem-solving, organiza-
tional and presentation skills. Employers typically
look for six or more years of experience in QA,
along with several years of technical managerial
experience and a bachelor’s degree in informa-
tion systems, computer science or a related field.
Typical duties include:
• Managing a group of quality assurance
analysts/testers and directing their work
• Establishing quality assurance and/or quality
control policies in accordance with best prac-
tices and defining benchmarks and measures
• Preparing budget and staffing plans and
recommendations
• Ensuring proper coordination and collabora-
tion with technical teams

QA ANALYST
Candidates for QA analyst positions must have
excellent problem-solving skills, along with keen
attention to detail and outstanding written and oral
communication abilities. A bachelor’s degree in
computer science or a related discipline com-
bined with several years of experience in a QA
environment are typical requirements, although
work experience can sometimes be substituted for
formal education.
Typical duties include:
• Developing and executing software test plans
• Identifying and facilitating issue resolution with
functional and technical groups
• Managing software beta test programs
• Documenting test results

Web Development

SENIOR WEB DEVELOPER
Companies hiring senior web developers seek
individuals with extensive experience in all
phases of the web application development life

cycle, as well as an excellent understanding of
customer needs and business strategy. Candi-
dates should have expertise in the development
of multiplatform, distributed applications and
object-oriented programming. In addition, they
should be adept at working in a team environ-
ment and mentoring junior colleagues. Sample
code and web links to sample work are often
requested. Employers normally seek a bach-
elor’s degree in computer science, electrical
engineering or a related field, plus a minimum
of five years of experience working with a mix of
web technologies, such as AJAX, Adobe Flash,
JavaScript, SOAP and HTML/DHTML.
Typical duties include:
• Providing creative vision and managing the
planning and implementation of web-based
applications
• Coordinating and communicating cross-
functional activities among product develop-
ment, marketing, product management and
other teams in bringing new applications online
• Diagnosing and fixing bugs found by quality
assurance testers
• Overseeing application coding and providing
technical expertise and mentoring to other
developers
• Increasing online exposure through search
engine optimization best practices

WEB DEVELOPER
Web developers should have in-depth knowl-
dge of Internet protocols and applications, in
addition to a solid understanding of business
strategy. They need strong communication skills
and the ability to work both individually and as
part of a team. Employers typically seek indi-
viduals with a bachelor’s degree in computer
science or a related field, plus several years of
web-related experience. Work experience can
sometimes be substituted for the educational
requirement. Sample code and web links to
sample work are often requested. Candidates
should be well-versed in web technologies and
tools, such as AJAX, ColdFusion, JavaScript,
SOAP, HTML/DHTML, LAMP and others.
Typical duties include:
• Gathering business requirements and develop-
ing specifications for web-based applications
• Providing technical assistance to web
administrators
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- Integrating websites with back-end systems such as databases
- Writing test plans and test results

**WEB ADMINISTRATOR**
Candidates for web administrator positions need a thorough understanding of web technology and the Internet. They should be experienced in working with firewalls, intranets, domain name services, servers, and the related hardware and software required to administer a website. Familiarity with web services, TCP/IP, FTP, HTTP and HTTPS, LDAP and similar Internet protocols also is required. A bachelor’s degree in a computer-related field and at least two to three years of experience in a web administration role are standard requirements, although additional experience in web-related positions may sometimes be substituted for formal education. In addition, web administrators should have excellent communication and customer service skills and the ability to work well in a team environment. Typical duties include:
  - Installing, customizing, updating and maintaining corporate internal and external web pages and sites
  - Creating and analyzing reports on web activity, number of hits, traffic patterns and similar performance metrics
  - Monitoring customer feedback and responding to inquiries
  - Recommending network, server and related equipment, and software upgrades and improvements

**WEB DESIGNER**
Web designers must be creative and possess excellent design and conceptual skills in combination with in-depth knowledge of the technology and software used to create web pages. They need to be familiar with HTML, XML, JSP, CSS, PHP, AJAX, and similar web languages and platforms, as well as the following Adobe web page and design software: Photoshop, Illustrator, Acrobat, Dreamweaver and Flash. The ability to multitask and adapt to changing priorities and new technologies also is essential. Employers may require a bachelor’s degree in fine arts, graphic design or communications but often are more interested in three or more years of design and production experience and a strong portfolio of web designs. Typical duties include:
  - Working with design teams, marketing staff and developers to create a consistent and compelling visual style for a company’s website
  - Designing and formatting web pages
  - Testing and troubleshooting web page features
  - Creating artwork to appear on web pages

**E-COMMERCE ANALYST**
E-commerce analysts must possess a strong background in Internet technologies, along with excellent communication, interpersonal, analytical and problem-solving skills. They also should be familiar with business and marketing concepts and be comfortable making recommendations based on strong attention to detail and strategic thinking. Employers typically seek a bachelor’s degree in business, computer science, marketing, economics or a related field of study, plus a minimum of three years of professional IT experience, including work in web-related functions. Typical duties include:
  - Analyzing business and user requirements and making recommendations regarding the design and development of web-based e-commerce solutions
  - Coordinating work with web designers and other technical specialists for the implementation of e-commerce websites
  - Training and mentoring colleagues on Internet strategy and best practices
  - Testing and evaluating e-commerce site performance and monitoring site analytics

**NETWORKING/TELECOMMUNICATIONS**

**NETWORK ARCHITECT**
Individuals pursuing this position need an extensive background in all aspects of networking technology. They must possess excellent written and oral communication skills, along with strong interpersonal and leadership abilities. Employers generally seek a bachelor’s degree in a computer-related field, along with at least seven years of experience with network operating systems such as Cisco, Novell and Windows Server. Network architects also should have experience working with routers, switches, cabling and other essential network hardware. A networking certification from sources such as Cisco, Microsoft or Novell also is highly valued.
Typical duties include:
• Assessing business and applications requirements for corporate data and voice networks
• Planning, designing and upgrading network installation projects
• Establishing and maintaining backup, version-control and viral defense systems
• Troubleshooting network architecture and making recommendations for system fixes and enhancements
• Making recommendations for leveraging network installations and reducing operational costs

**NETWORK MANAGER**
Companies hiring network managers seek candidates who have experience working with data and voice networking, along with excellent operational knowledge of network hardware and software. In addition, network managers need outstanding interpersonal, management, and oral and written communication skills, as well as the ability to multitask. Employers look for 10 or more years of experience in a networking environment combined with several years of experience managing technical personnel. A Microsoft, Cisco or similar professional certification also is valuable.

Typical duties include:
• Directing day-to-day operations and maintenance of the firm’s networking technology
• Collaborating with network engineers, architects and other team members on the implementation, testing, deployment and integration of network systems

**NETWORK ENGINEER**
Network engineers must be detail-oriented and have in-depth knowledge of networking hardware and software. A bachelor’s degree in computer science or electrical engineering and five or more years of experience in areas such as network design and implementation, LAN/WAN interfacing, security, Internet protocols and TCP/IP, and server and network infrastructure are typical job requirements. A professional certification, such as the Cisco Certified Internet Network Expert (CCIE), also is highly desirable.

Typical duties include:
• Engineering enterprise data, voice and video networks
• Establishing and operating network test facilities
• Maintaining a secure transfer of data to multiple locations via internal and external networks
• Working with vendors, clients, carriers and technical staff on network implementation, optimization and ongoing management
• Providing high-level support and technical expertise in networking technology, including LAN/WAN hardware, hubs, bridges and routers

**WIRELESS NETWORK ENGINEER**
Candidates for the position of wireless network engineer need strong analytical and problem-solving skills, and must be knowledgeable about all aspects of network technology. A background in wireless equipment, standards, protocols and WLAN design is considered ideal. Candidates also must be effective communicators in order to collaborate successfully with network technicians, vendors and managers. Employers typically look for a bachelor’s degree in computer science, engineering or a related field (or equivalent work experience), plus five or more years in LAN/WAN engineering and design work, including several years specializing in wireless technologies such as Wi-Fi, WiMax and WAP. Professional certifications such as the Certified Wireless Network Professional (CWNP) also are valuable.

Typical duties include:
• Researching, designing and implementing wireless networks, including all engineering specifications and resource requirements for network hardware and software
• Making recommendations for wireless network optimization, additions and upgrades to meet business requirements
• Conducting and documenting radio frequency (RF) coverage and site surveys
• Documenting network infrastructure and design

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**Glossary of Job Descriptions**

**NETWORK MANAGER**
Companies hiring network managers seek candidates who have experience working with data and voice networking, along with excellent operational knowledge of network hardware and software. In addition, network managers need outstanding interpersonal, management, and oral and written communication skills, as well as the ability to multitask. Employers look for 10 or more years of experience in a networking environment combined with several years of experience managing technical personnel. A Microsoft, Cisco or similar professional certification also is valuable.

Typical duties include:
• Directing day-to-day operations and maintenance of the firm’s networking technology
• Collaborating with network engineers, architects and other team members on the implementation, testing, deployment and integration of network systems
NETWORK ADMINISTRATOR

Network administrators need solid technical skills and experience with a variety of network protocols, software and hardware involved in LAN and WAN operations. The position requires strong troubleshooting, analytic and diagnostic skills, along with good communication abilities. In addition, firms may require the individual to be on call 24/7 in case of network failures or emergencies. While some employers prefer a bachelor’s degree in computer science or information systems, five or more years of work experience, as well as professional certifications offered by Microsoft, Cisco and others, often can be substituted.

Typical duties include:
• Administering the operation of all LAN/WAN-related network services according to company policies and procedures
• Coordinating and implementing network software and hardware upgrades
• Troubleshooting and resolving LAN/WAN performance, connectivity and related network problems
• Administering LAN/WAN security, antivirus and spam control measures

PRE-SALES ENGINEER/TECHNICAL ENGINEER

Candidates seeking a position as a pre-sales engineer/technical engineer need proven technology skills combined with outstanding interpersonal and teamwork abilities. They should possess strong written and verbal communication skills, attention to detail, and analytical and problem-solving capabilities. A positive, service-oriented personality is required as these individuals will often meet with clients or potential clients as part of the sales team. Many positions require a substantial amount of travel. Employers generally seek a bachelor’s degree or equivalent combination of education and work experience in engineering, information systems or business administration, depending on the product or service being sold. Five years of industry experience, including two or more years in sales engineering or consulting work, are typically required.

Typical duties include:
• Collaborating as a member of a sales support or account team by participating in customer presentations as the technical expert
• Determining technical requirements to meet client goals and acting as the liaison between the firm’s sales/business development and engineering groups
• Responding to requests for information (RFIs) or requests for proposals (RFPs) from current or potential customers with technical details of proposed solutions
• Coordinating the transition between pre-sales specifications and implementation engineering upon the awarding of contracts

TELECOMMUNICATIONS MANAGER

Telecommunications managers should have an extensive background in telecommunications practice, including hands-on experience with associated hardware and software. They should have excellent communication, staff management, problem-solving and organizational abilities.

Employers generally seek a bachelor’s degree in a related field, along with a minimum of five years of telecommunications experience, plus two or more years as a supervisor or manager.

Typical duties include:
• Overseeing a team of analysts and technicians who support a firm’s telecommunications infrastructure
• Managing the telecommunications budget and analyzing expenditures for cost containment
• Evaluating equipment vendors; building relationships with service providers; and coordinating equipment installation, relocation and removal
• Researching and making recommendations to IT management related to telecommunications systems upgrades, improvements and long-range strategy

TELECOMMUNICATIONS SPECIALIST

Telecommunications specialists need a detailed understanding of telecommunications theory and practice. They should have solid technical skills, as well as interpersonal and organizational abilities. Employers may seek an associate’s degree in electronics or a related field but are equally interested in several years of hands-on experience with communications equipment. Experience working with the specific hardware used in the company’s telecommunications system, as well as with cabling and transmission test equipment, is highly valued.

Typical duties include:
• Installing, configuring and maintaining voice, data and video equipment
• Installing and testing cabling
• Investigating and resolving trouble ticket items and making necessary equipment repairs
• Resolving circuit issues
• Maintaining system logs and records

Operations

MANAGER
An in-depth background in computer operations combined with supervisory experience is required for the position of operations manager. Managers should have excellent planning, project management and problem-solving skills, along with superior communication and interpersonal abilities. A bachelor’s degree in a computer-related field or equivalent work experience is a standard requirement. Firms normally seek a minimum of five years of operations experience in combination with three or more years of managing technical personnel. Typical duties include:
• Directing and managing the daily activities of the computer operations department
• Supervising a staff of computer operators and other technicians, assigning their duties and preparing performance reviews
• Analyzing system malfunctions or technical problems and directing appropriate resolution to ensure uninterrupted operations
• Coordinating operations information and activities with other IT managers

COMPUTER OPERATOR
Computer operators need to be detail-oriented team players with good analytical and trouble-shooting skills. Candidates also must possess the ability to multitask. They should have a strong service orientation and be able to maintain a flexible work schedule. Employers seek candidates with good working knowledge of the hardware and operating system environment used by their firm. A formal postsecondary education often is less critical than several years of related work experience, although system certification is a valuable asset. Typical duties include:
• Operating and monitoring mainframe computer equipment and peripherals
• Performing system backups
• Identifying equipment problems and initiating corrective action
• Keeping required logs and system records according to departmental procedures

MAINFRAME SYSTEMS PROGRAMMER
Systems programmers must possess experience with mainframe computer programming languages and applications development. They should be analytical problem solvers with good communication and organizational skills and have the ability to work individually and as part of a technical team. Typical requirements include a bachelor’s degree in computer science or a related field, plus three to five years of work experience in the development of complex systems in a mainframe environment. Additional work experience can sometimes be substituted for the educational requirement. Typical duties include:
• Designing logic, writing code, and testing and debugging mainframe computer applications
• Installing and implementing programs and upgrades
• Diagnosing and resolving system problems in coordination with other technical team members
• Documenting procedures for mainframe configuration and operation

Security

DATA SECURITY ANALYST
Data security analysts must possess a thorough understanding of all aspects of computer and network security, including such areas as firewall administration, encryption technologies and network protocols. Analysts need strong oral and written communication, analytical, and problem-solving skills, as well as excellent judgment and self-motivation. They should be able to multitask and work well under pressure. It is important that candidates keep abreast of industry security trends and developments, as well as applicable government regulations. Employers generally seek a bachelor’s degree in a computer-related field, along with at least three years of practical data security experience. A professional certification such as the Certified Information Systems Security Professional (CISSP) designation also is a valuable asset.
Glossary of Job Descriptions

Typical duties include:
• Performing security audits, risk assessments and analysis
• Making recommendations for enhancing data systems security
• Researching attempted breaches of data security and rectifying security weaknesses
• Formulating security policies and procedures

SYSTEMS SECURITY ADMINISTRATOR
Systems security administrators must demonstrate technical knowledge of data systems security procedures and familiarity with systems hardware and software. They should have good communication skills and the ability to work well in a team setting. It is important that candidates keep abreast of industry security trends and developments, as well as applicable government regulations. A bachelor’s degree in computer science or a related field, plus several years of computer systems and security-related experience, are typical requirements for the job, although relevant work experience can sometimes be substituted for a four-year degree. Typical duties include:
• Creating, modifying and deleting user accounts
• Monitoring systems security and responding to security incidents
• Participating in security systems testing
• Ensuring integrity and confidentiality of sensitive data
• Preventing and detecting intrusion

NETWORK SECURITY ADMINISTRATOR
Individuals interested in a network security administrator position need a strong technical background, including working knowledge of network management protocols, networking architecture, authentication practices and security administration. It is important that candidates keep abreast of industry security trends and developments, as well as applicable government regulations. They also should have excellent troubleshooting and communication skills. Employers typically seek a bachelor’s degree in a technical field, along with three to six years of relevant experience. Typical duties include:
• Implementing network security policies and procedures
• Administering and maintaining firewalls
• Managing, monitoring and updating malware prevention systems
• Monitoring security advisory groups to ensure all necessary network security updates, patches and preventive measures are in place
• Performing intrusion detection analysis
• Preventing and detecting intrusion

NETWORK SECURITY ENGINEER
Network security engineers must be able to translate security policies and procedures into technical architectures. Employers seek strong working knowledge of data and network security technologies, as well as at least five years of experience installing, monitoring and maintaining network security solutions. Candidates should have excellent organizational, multitasking and communication skills. A four-year college degree in a technical field and a Cisco or other security-related certification may also be required. Typical duties include:
• Analyzing performance, identifying areas of concern and formulating action plans
• Creating and maintaining documentation of network configurations and processes
• Post-deployment monitoring and testing
• Planning, testing and executing upgrades as necessary

INFORMATION SYSTEMS SECURITY MANAGER
The position of information systems security manager requires an individual with a strong technical background in systems and network security, along with excellent interpersonal and leadership abilities. Superior analytical and problem-solving skills, as well as exceptional written and verbal communication skills, also are essential. It is important that candidates keep abreast of industry security trends and developments, as well as applicable government regulations. Employers normally seek a bachelor’s degree in information systems, computer science or a related discipline (or an equivalent combination of education and experience), along with five or more years of systems and network security experience. One or more years of managerial experience may also be required.
Industry certifications such as the Certified Information Systems Security Professional (CISSP) or the CompTIA Security+ also are commonly sought by employers.

Typical duties include:
• Providing leadership, guidance and training to information systems security personnel
• Reviewing, implementing, updating and documenting companywide information security policies and procedures
• Managing security audits, vulnerability and threat assessments and directing responses to network or system intrusions
• Ensuring fulfillment of legal and contractual information security and privacy mandates, including providing executive management with compliance reports and audit findings
• Preventing and detecting intrusion

Software Development

PRODUCT MANAGER
Product managers need a blend of business and marketing talent combined with technical knowledge. They should have excellent communication skills, including the ability to deal effectively with both technical staff and business/sales professionals, as well as a capacity for seeing the big picture in terms of product life cycle. Requirements include a bachelor’s degree in computer science or business, plus five or more years of experience in software product management. For some positions, an MBA is highly desirable.

Typical duties include:
• Coordinating work with software engineers and developers to define product requirements
• Working with sales and marketing to define customer needs, market potential, competitive analysis and marketing strategy
• Writing product information materials to brief sales personnel on product features and benefits
• Assisting with trade show presentations of the product

SOFTWARE ENGINEER
Candidates for a software engineer position should have broad information systems experience. They should be adept at working in a team environment and possess excellent communication and problem-solving skills. Most jobs require a minimum of a bachelor’s degree in computer science, electrical engineering, computer engineering or a related discipline. Several years’ experience in specific programming languages, such as C#/C++, Java or .NET, depending on what the employer is using, also is valuable.

Typical duties include:
• Designing and creating engineering specifications for software programs and applications
• Working with quality assurance to develop software test plans
• Collaborating with hardware engineers to assess and test hardware and software interaction
• Implementing a specific development methodology
• Documenting software specifications

SOFTWARE DEVELOPER
Software developers need to be detail-oriented and have excellent problem-solving and analytical abilities. They should have good communication skills and be able to work independently and as part of a development team. Employers normally require a bachelor’s degree in computer science or a similar field but may accept a two-year technical degree if combined with several years of practical experience. Equally important are programming skills in languages and frameworks such as C#/C++, HTML, Java/Java Enterprise Edition, Microsoft .NET and SQL Server. A minimum of two to three years of programming experience is a typical requirement. Complex projects may call for additional years of demonstrated achievement.

Typical duties include:
• Coding, testing and debugging programs according to computer engineering specifications
• Modifying, expanding and updating applications
• Communicating with a team that includes analysts, engineers and quality assurance testers in order to coordinate and document application development and testing
• Developing software prototypes
Technical Services, Help Desk & Technical Support

MANAGER
Managers of technical support services need extensive experience with supported software and hardware, as well as excellent interpersonal, business management and customer service skills. The position also requires strong leadership skills. Employers typically seek a bachelor’s degree in information systems or a related discipline with at least five years of operations and support experience, plus three or more years in a managerial role. Professional certifications such as the Microsoft Certified Systems Engineer (MCSE) or HDI’s Support Center Manager certification, or experience with the Information Technology Infrastructure Library (ITIL), also are valuable.

Typical duties include:
• Managing the daily operations of a firm’s help desk and support services
• Managing staff, including hiring, training, scheduling work assignments and conducting evaluations
• Monitoring response times, evaluating user satisfaction levels and making recommendations for improvement
• Evaluating and managing technical support systems hardware and software and making recommendations regarding upgrades or changes
• Negotiating, writing and reporting on internal and external service-level agreements

DESKTOP SUPPORT ANALYST
Candidates for a desktop support analyst position should have extensive experience with desktop hardware, software applications, operating systems and network connectivity. They must be customer service-oriented and proactive in anticipating and resolving problems while maximizing efficient use of computing resources. A bachelor’s degree in a computer-related field and three to five years of experience installing and supporting PC and laptop hardware and software are standard requirements, although some employers are willing to substitute work experience for formal education. Additional requirements may include professional certifications from entities such as HDI (Desktop Support Technician or Support Center Analyst), CompTIA or Microsoft (Microsoft Certified IT Professional or Microsoft Certified Systems Administrator).

Typical duties include:
• Maintaining an inventory of installed software, managing software licensing, and creating policies and procedures for upgrades
• Working with hardware and software vendors to verify timely product delivery and ensuring that new equipment is installed and ready to operate on schedule
• Analyzing and making recommendations for hardware and software standardization
• Creating user accounts and managing access control based on company policies

SYSTEMS ADMINISTRATOR
Systems administrators should possess strong problem-solving, analytical and communication skills, in addition to in-depth technical knowledge of the employer’s systems hardware and software. Employer requirements vary depending on system complexity, the types of operating and network systems being supported, and the size of the organization. While some employers require a bachelor’s degree in computer science or a related field, others may accept an associate’s degree or technical training certificate. Three to five years of experience working with the specific types of hardware and software systems used by the company are generally required. Professional certifications such as the Microsoft Certified Systems Administrator (MCSA), Microsoft Certified Systems Engineer (MCSE) or Sun Certified System Administrator (SCSA) may be commonly sought by employers.

Typical duties include:
• Installing operating system software, patches and upgrades
• Analyzing, troubleshooting and resolving system hardware, software and networking issues
• Configuring, optimizing, fine-tuning and monitoring operating system software and servers
• Performing system backups and recovery
• Conducting server builds

SYSTEMS ENGINEER
In addition to in-depth technical knowledge of the employer’s software and hardware, systems engineers need advanced analytical,
troubleshooting and design skills. The ability to communicate with technical and nontechnical users also is essential. Employers may require extensive knowledge of the development process, including specification, documentation and quality assurance. Because of the broad range of demands systems engineers must meet, candidates who have demonstrated strong project planning skills often hold an advantage. Employers generally prefer candidates with five or more years of experience working with the specific hardware and software systems used by the company, as well as a bachelor’s degree or equivalent experience.

Typical duties include:
- Developing, maintaining and supporting technical infrastructure, hardware and system software components
- Performing installation, maintenance and support of system software/hardware and user support
- Configuring, debugging and supporting multiple infrastructure platforms
- Performing high-level root cause analysis for service interruption recovery and creating preventive measures

MESSAGING ADMINISTRATOR
Messaging administrators must be detail-oriented with excellent problem-solving, communication and documentation skills. They should have hands-on experience working with the hardware and software components of messaging systems such as Microsoft Exchange, Outlook, Active Directory and Lotus Notes, plus handheld devices, and a strong understanding of malware protection. Messaging administrators must be comfortable in a fast-paced environment with rapidly changing technology. A bachelor’s degree in computer science, computer information systems or a related field, plus at least two years of experience working with the messaging systems used by the employer, are standard requirements.

Typical duties include:
- Implementing, administering and maintaining email and groupware systems, including associated servers, operating systems, and backup and recovery programs
- Troubleshooting and fixing system problems and service requests, and providing high-level technical support for unresolved help desk issues
- Formulating and documenting standard procedures for messaging system administration
- Identifying areas for enterprisewide system improvements and upgrades, including trending analysis and capacity planning
- Planning, documenting and testing appropriate messaging-related disaster recovery and/or business continuity systems
- Planning, documenting and testing appropriate messaging-related disaster recovery and/or business continuity systems

HELP DESK (TIERS 1, 2 & 3)
All help desk personnel need excellent problem-solving, communication and interpersonal skills, along with patience, a customer-friendly attitude and the ability to work in a team environment. In addition, they should have a strong technical understanding of the various hardware, software and networking systems being supported. Employer requirements depend on the help desk position level. Tier 1, an entry-level position, normally requires less than two years of work experience and may require an associate’s degree or completion of coursework at a technical school. Tier 2 positions typically require two to four years of work experience and may require a bachelor’s degree or a two-year degree and additional, equivalent work experience in a help desk setting. Tier 3 positions often require four or more years of help desk experience, a bachelor’s degree in computer science or a related field and/or professional certification, such as HDI’s Customer Service Representative or Support Center Analyst or the Microsoft Certified Systems Engineer (MCSE) designation.

Typical duties include:

**Tier 3**
- Researching and resolving the most difficult and complex problems that other help desk levels have been unable to resolve
- Analyzing and identifying trends in issue reporting and devising preventive solutions
- Mentoring other help desk personnel on hardware and software problem analysis and resolution

**Tier 2**
- Resolving more complex issues requiring detailed systems and applications knowledge; these issues have been escalated from Tier 1
- Making the decision to generate a trouble or work order ticket for issues that will require a visit to the user’s PC or workstation
Tier 1
• Taking initial telephone or email inquiries and troubleshooting and managing relatively simple hardware, software or network problems
• Recognizing and escalating more difficult problems to Tier 2 support
• Logging call activity

INSTRUCTOR/TRAINER
Candidates for an instructor/trainer position require a combination of in-depth subject-matter expertise and excellent communication and presentation skills. They must be able to explain sometimes difficult technical material clearly and patiently to students with varying levels of proficiency. Candidates should be outgoing and comfortable working with diverse groups of people while maintaining professionalism at all times. A bachelor’s degree in a related subject area may be preferred by some employers. Breadth of technical knowledge and at least one year of training experience also are required. Certification, such as a Microsoft Certified Trainer (MCT) designation, also can be useful.

Typical duties include:
• Determining training objectives and developing a course curriculum
• Creating course materials, handouts, instructional aids, audio/visual materials and similar teaching aids
• Conducting classroom training
• Testing and evaluating student performance

PC TECHNICIAN
PC technicians need excellent problem-solving and customer service skills, as well as thorough knowledge of PC hardware, software and network connections. Employers look for relevant training, which may include an associate’s degree or completion of coursework through a technical school, as well as hands-on experience working with PC hardware and software. One to five years of previous experience may be required, depending on the complexity of the position. Professional certifications, such as the CompTIA IT Technician or Microsoft Certified IT Professional designation, also provide important skills validation and may be a requisite.

Typical duties include:
• Installing, configuring and maintaining desktop and laptop PCs and peripherals such as printers
• Installing and configuring application and operating system software and upgrades
• Troubleshooting and repairing hardware and network connectivity issues
• Removing old equipment and performing data migration to new machines

BUSINESS CONTINUITY ANALYST
Individuals interested in a business continuity analyst position need excellent analytical, organizational, communication and documentation skills. A background in project management and/or business or systems analysis, and in-depth knowledge of a business sector such as finance or securities, is considered ideal.

Employers typically seek five or more years of experience in IT-related positions, along with several years of business continuity planning experience. A minimum of a bachelor’s degree in computer science or a related field is a standard educational requirement.

Typical duties include:
• Analyzing critical business functions and defining the scope and impact of disaster scenarios
• Designing, planning and implementing an enterprisewide business continuity plan
• Analyzing existing systems and recommending redundant, fault-tolerant solutions to ensure business continuity and duplication of all critical data
• Devising, scheduling and implementing business continuity tests and analyzing results
• Documenting business continuity procedures, and making presentations and recommendations to senior management
• Ensuring that the firm and its data systems are in compliance with regulations such as the Sarbanes-Oxley Act, Gramm-Leach-Bliley Act and Health Insurance Portability and Accountability Act in the United States or Multilateral Instrument 52-109 in Canada
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Robert Half Technology offers project, contract-to-hire and full-time staffing, as well as managed IT service solutions, worldwide to organizations that require on-demand technical expertise. The following business functions are representative of the technology project services we offer:

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*Available only in the United States.*
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Ontario  
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Fort Lauderdale  
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**Georgia**  
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Chicago  
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**Tennessee**  
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Nashville

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Austin  
Dallas – Downtown  
Dallas – Galleria  
Fort Worth  
Houston – Galleria  
Houston – Westchase  
Houston – The Woodlands  
San Antonio

**Utah**  
Salt Lake City

**Virginia**  
Richmond  
Tysons Corner

**Washington**  
Bellevue  
Seattle

**Wisconsin**  
Madison  
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Worldwide Locations

**Australia**  
Brisbane  
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Sydney

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