2016
SALARY GUIDE
FOR TECHNOLOGY PROFESSIONALS

rh Robert Half®
Technology

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Introduction

Competition among businesses for top IT talent today makes it critical for managers to rethink their recruitment and retention methods. Speeding up hiring times, training from within, filling skills gaps with project professionals and offering attractive compensation can help you hire – and keep – the best and brightest for your organization.

In particular, the salaries you offer must be kept at least on par with those of other firms in your industry and geographic region. But to do that, you have to stay continually up to date on what your competitors are offering. To help you benchmark your compensation levels, Robert Half Technology releases a *Salary Guide* every year, complete with the most current information and advice on starting compensation, workplace issues and the hiring outlook.

We are pleased to present the *2016 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 salary information in the guide is based on the real-life observations of our Robert Half Technology staffing and recruiting professionals who make thousands of interim and full-time placements each year, as well as our frequent surveys of chief information officers (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.

Salary Calculator

Hiring Trends

Regional Trends

For additional insights on compensation and staffing, please visit our Salary Center at **rht.com/salary-center**.

IT Hiring Trends: So Many Jobs, So Few Applicants

A demand and supply imbalance that has affected the IT hiring market for years will likely continue in 2016.

The signs are here already. So many IT-related positions are being created that employers throughout North America and across industries often must wait months to staff key roles. What's new is that tech jobs are remaining open because candidates aren't even applying.

It isn't just the shallow pool of available talent contributing to the lack of response; it's that many candidates don't have to look very far – or at all – to find their pick of employment opportunities.

Highly skilled and experienced IT professionals, even those who aren't actively seeking jobs, often receive multiple offers. And the employment offers are fiercely competitive: Above-market pay and other attractive financial incentives are common, and offers may include stock options, flexible work schedules and other perks.

In this market, employers must move quickly. Organizations that have lengthy interview processes or wait too long to extend job offers can easily miss the opportunity to make a great hire.

NEW RECRUITMENT STRATEGIES

Senior-level technology professionals are perpetually in demand, especially to help lead IT initiatives. Cost can be a barrier to hiring these candidates, since many companies simply don't have the budgets to prevail in a bidding war for top talent.

That's why more firms are now looking to grow their own talent, upping their investment in developing high-potential internal employees and making more entry-level hires. Employers are also more willing to "stretch," helping a candidate to fit into a role versus waiting to find someone who meets all of their hiring criteria.

The need for highly skilled IT talent also has more employers looking outside of their local areas for potential hires, paying relocation expenses or offering candidates the opportunity to work remotely.

WHERE THE JOBS ARE

Project work and consulting roles will likely remain abundant in 2016. Increasing business demands are prompting many companies to invest in new technologies, along with upgrades and migration projects around tools such as enterprise resource planning (ERP) systems. Candidates who have knowledge of both new and legacy business systems are highly sought after by employers.

HOT INDUSTRIES FOR IT HIRING

Here are some sectors that will be especially active with IT hiring in the year ahead:

• **Financial services**: Financial services providers are offering more technology-enabled services to customers, such as online banking and brokerage services. There is a business-critical need for reliability and connectivity for both internal and customer-facing systems and apps.

• **Healthcare**: Healthcare organizations are embracing new technologies to meet regulatory compliance demands, accelerate innovation and improve the quality of patient care.

• **Managed services**: More companies are relying on managed services providers for day-to-day IT needs, from data storage to network management.

• **Telecommunications**: Trends include relentless demand for connectivity and speed in communication, robust growth in devices and services, and network convergence.

• **Hospitality:** There is a push to deliver reliable technology services to consumers – from online booking to hotel Wi-Fi – and provide outstanding user experiences and support.

Mobile technology, big data and security will continue to be major drivers for IT hiring throughout 2016, in these industries as well as many others.
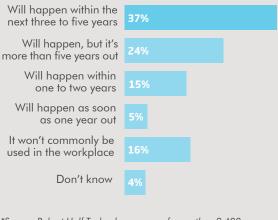
EMERGING JOB MARKET: WEARABLE TECH

The growing popularity of wearable computing devices – such as watches and glasses – could drive IT job creation. Expertise will be needed for the development of new devices and related applications, as well as to support the adoption of wearable technology in the workplace.

81%

of CIOs believe wearables will happen in the workplace.

When, if at all, do you think wearable technology will be a commonly used workplace tool?*

Will happen within the next three to five years	**37%**
Will happen, but it's more than five years out	**24%**
Will happen within one to two years	**15%**
Will happen as soon as one year out	**5%**
It won't commonly be used in the workplace	**16%**
Don't know	**4%**

*Source: Robert Half Technology survey of more than 2,400 CIOs in the United States
*Responses do not total 100 percent due to rounding.

TECH ROLES IN DEMAND

Businesses across North America are hiring for the following roles:

- **Developers:** Web, software and mobile app developers – employers across industries are looking to hire them all. Those with .NET, PHP and MySQL skills, as well as those with responsive design skills, are in high demand.

- **Business analysts and quality assurance (QA) professionals:** As companies launch new IT initiatives, they need business analysts who can bridge the gap between technology efforts and business users. QA professionals help keep projects on the mark through testing and assurance efforts.

- **Systems engineers and systems administrators:** Systems engineers with virtualization skills and systems administrators are needed by many firms to manage the convergence of networking, systems and data storage. Many firms especially value SharePoint or Salesforce experience.

- **Database administrators and business intelligence analysts:** More companies are using big data analytics to help inform business decisions and are relying on specialized personnel for managing and interpreting raw data.

- **Help desk and desktop support:** Many employers are looking to expand their support teams as they embrace mobility and "bring your own device" initiatives. Technical assistance is also needed specifically for managing issues related to the Microsoft System Center Configuration Manager (SCCM).

TOP TECHNICAL SKILLS

Although specific requirements for IT positions vary across industries and regions, the following skills are in high demand with employers throughout North America:

- ASP, C#, Java, .NET, PHP, Python, Ruby on Rails
- Virtualization skills
- Windows 7 skills

8 STRATEGIES FOR RECRUITING AND RETAINING IT TALENT

One of the best ways to approach the shortage of highly skilled talent is to build a reputation as an employer of choice. Here are eight strategies for achieving that status:

1. Pay at or above market salaries for top talent.

2. Provide exciting and challenging assignments.

3. Foster a corporate culture where innovation rules, and business and technology are intertwined.

4. Make sure tech pros have the latest tools.

5. Promote flexible schedules and remote working arrangements.

6. Offer professional development opportunities.

7. Show a clear path for growth and promotion.

8. Listen to employees and take action on their requests, as appropriate.

Another strategy for success: Establish a strong employee referral program. Referrals can be the key to connecting with in-demand talent before the competition even knows these professionals are in the market.

Technology Salaries – U.S.

Title	2015	2016	% Change
Administration			
Chief Information Officer (CIO)	$ 157,000 - $ 262,500	$ 172,000 - $ 268,250	4.9%
Chief Technology Officer (CTO)	$ 137,500 - $ 220,250	$ 147,500 - $ 229,000	5.2%
Chief Security Officer (CSO)	$ 134,250 - $ 204,750	$ 140,250 - $ 222,500	7.0%
Vice President of Information Technology	$ 138,000 - $ 210,250	$ 141,000 - $ 225,000	5.1%
Technology Director	$ 118,750 - $ 174,000	$ 122,750 - $ 185,000	5.1%
Information Technology Manager	$ 101,750 - $ 150,750	$ 105,750 - $ 159,000	4.9%
Applications Development (a)			
Manager	$ 103,250 - $ 150,750	$ 105,750 - $ 160,500	4.8%
Project Manager	$ 91,250 - $ 139,250	$ 95,250 - $ 146,500	4.9%
Systems Analyst	$ 79,500 - $ 114,500	$ 81,750 - $ 121,000	4.5%
Applications Architect	$ 115,750 - $ 159,500	$ 121,250 - $ 171,750	6.4%
Business Systems Analyst	$ 79,250 - $ 116,500	$ 84,000 - $ 122,000	5.2%
CRM Business Analyst	$ 84,500 - $ 116,750	$ 87,500 - $ 126,000	6.1%
CRM Technical Developer	$ 93,500 - $ 129,250	$ 98,500 - $ 137,750	6.1%
Developer/Programmer Analyst	$ 74,250 - $ 129,000	$ 80,000 - $ 137,000	6.8%
ERP Business Analyst	$ 87,500 - $ 124,500	$ 92,500 - $ 132,000	5.9%
ERP Technical/Functional Analyst	$ 94,750 - $ 132,000	$ 98,000 - $ 140,750	5.3%
ERP Technical Developer	$ 99,750 - $ 136,750	$ 100,750 - $ 148,500	5.4%
Lead Applications Developer	$ 106,250 - $ 148,250	$ 110,750 - $ 160,750	6.7%
Mobile Applications Developer	$ 107,500 - $ 161,500	$ 115,250 - $ 175,750	8.2%
Technical Writer	$ 55,000 - $ 85,250	$ 55,500 - $ 87,250	1.8%

(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 6%
C# development skills 8%
C++ development skills 5%
Hyperion skills 6%
Java development skills 9%
Java EE/J2EE development skills 8%
LAMP (Linux, Apache, MySQL and Perl/PHP/Python) skills 8%
.NET development skills 8%
PHP development skills 8%
SAP development skills............................... 6%
SharePoint skills 9%

Title	2015	2016	% Change
Consulting & Systems Integration			
Director	$ 119,750 - $ 178,750	$ 123,750 - $ 190,250	5.2%
Practice Manager	$ 119,250 - $ 164,750	$ 125,000 - $ 173,500	5.1%
Project Manager/Senior Consultant	$ 98,750 - $ 144,250	$ 100,750 - $ 154,250	4.9%
Staff Consultant	$ 77,500 - $ 108,750	$ 79,250 - $ 116,250	5.0%
Senior IT Auditor	$ 111,750 - $ 155,500	$ 116,000 - $ 164,250	4.9%
IT Auditor	$ 94,500 - $ 134,500	$ 95,000 - $ 144,750	4.7%
Data/Database Administration (b)			
Big Data Engineer	$ 119,250 - $ 168,250	$ 129,500 - $ 183,500	8.9%
Database Manager	$ 112,250 - $ 160,250	$ 118,000 - $ 170,500	5.9%
Database Developer	$ 98,000 - $ 144,750	$ 103,250 - $ 153,250	5.7%
Database Administrator	$ 91,000 - $ 134,750	$ 95,750 - $ 142,750	5.6%
Data Analyst/Report Writer	$ 70,750 - $ 108,250	$ 74,500 - $ 114,500	5.6%
Data Architect	$ 119,750 - $ 164,750	$ 127,250 - $ 175,500	6.4%
Data Modeler	$ 101,750 - $ 145,250	$ 106,750 - $ 155,500	6.2%
Data Scientist	$ 103,000 - $ 138,250	$ 109,000 - $ 153,750	8.9%
Data Warehouse Manager	$ 119,750 - $ 163,000	$ 123,750 - $ 172,000	4.6%
Data Warehouse Analyst	$ 102,500 - $ 142,500	$ 105,000 - $ 152,000	4.9%
Business Intelligence Analyst	$ 108,500 - $ 153,000	$ 113,750 - $ 164,000	6.2%
Electronic Data Interchange (EDI) Specialist	$ 74,750 - $ 108,250	$ 76,500 - $ 115,500	4.9%
Portal Administrator	$ 92,750 - $ 127,250	$ 94,000 - $ 134,250	3.8%
Quality Assurance (QA) & Testing (c)			
QA Engineer – Manual	$ 63,750 - $ 88,250	$ 64,750 - $ 91,500	2.8%
QA Engineer – Automated	$ 74,250 - $ 103,750	$ 74,750 - $ 109,000	3.2%
QA/Testing Manager	$ 90,000 - $ 122,500	$ 93,750 - $ 127,500	4.1%
QA Associate/Analyst	$ 62,000 - $ 97,500	$ 65,000 - $ 100,250	3.6%

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

ETL skills.. 6%
Microsoft SQL Server database skills............ 10%
Oracle database skills 7%

(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%

Title	2015	2016	% Change
Web Development (d)			
Senior Web Developer	$ 104,500 - $ 144,250	$ 111,250 - $ 154,000	6.6%
Web Developer	$ 73,500 - $ 122,000	$ 78,500 - $ 129,500	6.4%
Front-End Web Developer	$ 72,500 - $ 107,500	$ 79,750 - $ 111,250	6.1%
Web Administrator	$ 66,500 - $ 102,000	$ 68,750 - $ 106,250	3.9%
Web Designer	$ 64,000 - $ 105,500	$ 67,000 - $ 112,250	5.8%
E-Commerce Analyst	$ 84,250 - $ 121,500	$ 88,000 - $ 129,500	5.7%
Networking/Telecommunications (e)			
Network Architect	$ 115,000 - $ 165,250	$ 120,000 - $ 175,000	5.3%
Network Manager	$ 98,000 - $ 137,250	$ 100,000 - $ 146,750	4.9%
Network Engineer	$ 90,750 - $ 131,250	$ 96,000 - $ 138,750	5.7%
Wireless Network Engineer	$ 99,000 - $ 137,500	$ 108,750 - $ 150,750	9.7%
Network Administrator	$ 71,250 - $ 105,750	$ 76,250 - $ 112,000	6.4%
Pre-Sales Engineer/Technical Engineer	$ 86,250 - $ 125,750	$ 90,750 - $ 132,750	5.4%
Telecommunications Manager	$ 86,000 - $ 118,500	$ 88,500 - $ 125,000	4.4%
Telecommunications Specialist	$ 59,000 - $ 91,250	$ 61,000 - $ 95,500	4.2%
Operations			
Manager	$ 65,500 - $ 93,500	$ 66,250 - $ 96,250	2.2%
Computer Operator	$ 34,750 - $ 48,000	$ 35,000 - $ 48,750	1.2%
Mainframe Systems Programmer	$ 61,500 - $ 85,000	$ 62,750 - $ 86,500	1.9%

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

AJAX (Asynchronous JavaScript and XML) development skills 6%
ASP development skills.............................. 5%
C# development skills 8%
ColdFusion development skills 4%
Content management system (CMS) skills 5%
DCOM/COM/ActiveX development skills........ 5%
Java development skills......................... 9%
Java EE/J2EE development skills................... 8%
LAMP (Linux, Apache, MySQL and Perl/PHP/Python) skills 8%
.NET development skills 8%

PHP development skills 8%
Python skills.. 6%
Ruby on Rails skills.................................... 6%
SharePoint skills 9%
Virtualization skills 8%
Web services development skills................... 8%

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

Cisco network administration skills 9%
Linux/Unix administration skills 8%
Voice over Internet Protocol (VoIP) administration skills........................ 5%
Windows 7 skills 5%

Title	2015	2016	% Change
Security (f)			
Data Security Analyst	$ 106,250 - $ 149,000	$ 113,500 - $ 160,000	7.1%
Systems Security Administrator	$ 100,000 - $ 140,250	$ 105,500 - $ 149,500	6.1%
Network Security Administrator	$ 99,250 - $ 138,500	$ 103,250 - $ 147,000	5.3%
Network Security Engineer	$ 105,000 - $ 141,500	$ 110,250 - $ 152,750	6.7%
Information Systems Security Manager	$ 122,250 - $ 171,250	$ 129,750 - $ 182,000	6.2%
Software Development (g)			
Product Manager	$ 101,750 - $ 145,000	$ 105,750 - $ 152,750	4.8%
Software Engineer	$ 96,000 - $ 147,250	$ 103,000 - $ 156,250	6.6%
Software Developer	$ 85,500 - $ 136,250	$ 91,000 - $ 145,250	6.5%
Technical Services, Help Desk & Technical Support (h)			
Manager	$ 80,500 - $ 114,750	$ 84,500 - $ 121,000	5.2%
Desktop Support Analyst	$ 52,000 - $ 77,000	$ 54,250 - $ 80,500	4.5%
Systems Administrator	$ 65,750 - $ 100,500	$ 67,500 - $ 107,500	5.3%
Systems Engineer	$ 80,250 - $ 117,500	$ 85,000 - $ 124,000	5.7%
Messaging Administrator	$ 72,500 - $ 105,000	$ 74,000 - $ 111,750	4.6%
Help Desk Tier 3	$ 55,250 - $ 74,000	$ 59,500 - $ 77,750	6.2%
Help Desk Tier 2	$ 43,750 - $ 58,000	$ 45,250 - $ 61,750	5.2%
Help Desk Tier 1	$ 34,000 - $ 47,250	$ 35,000 - $ 50,250	4.9%
Instructor/Trainer	$ 54,250 - $ 87,250	$ 56,250 - $ 90,000	3.4%
PC Technician	$ 33,750 - $ 49,750	$ 36,000 - $ 51,750	5.1%
Business Continuity Analyst	$ 92,500 - $ 132,250	$ 97,250 - $ 140,000	5.6%

(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 8%

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

ASP development skills 5%
C# development skills 8%
C++ development skills 5%
DCOM/COM/ActiveX development skills 5%
Hadoop skills 7%

Java development skills 9%
Java EE/J2EE development skills 8%
.NET development skills 8%
PHP development skills 8%
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 8%
Virtualization skills 8%
Windows 7 skills 5%

Technology Salaries – Canada

Title	2015	2016	% Change
Administration			
Chief Information Officer (CIO)	$ 157,000 - $ 237,000	$ 165,500 - $ 245,000	4.2%
Chief Technology Officer (CTO)	$ 143,250 - $ 209,000	$ 149,250 - $ 219,250	4.6%
Chief Security Officer (CSO)	$ 138,000 - $ 219,750	$ 146,750 - $ 234,750	6.6%
Vice President of Information Technology	$ 151,000 - $ 225,000	$ 159,000 - $ 235,250	4.9%
Technology Director	$ 115,250 - $ 147,500	$ 120,000 - $ 155,250	4.8%
Information Technology Manager	$ 104,750 - $ 145,500	$ 109,250 - $ 152,750	4.7%
Applications Development (a)			
Manager	$ 109,750 - $ 146,750	$ 116,000 - $ 152,500	4.7%
Project Manager	$ 95,250 - $ 147,250	$ 99,750 - $ 154,750	4.9%
Systems Analyst	$ 81,250 - $ 108,250	$ 84,500 - $ 113,000	4.2%
Applications Architect	$ 110,000 - $ 143,250	$ 115,750 - $ 151,500	5.5%
Business Systems Analyst	$ 90,750 - $ 125,000	$ 94,750 - $ 130,000	4.2%
CRM Business Analyst	$ 88,750 - $ 113,000	$ 92,500 - $ 120,000	5.3%
CRM Technical Developer	$ 89,000 - $ 120,250	$ 93,500 - $ 126,250	5.0%
Developer/Programmer Analyst	$ 79,250 - $ 119,250	$ 85,000 - $ 125,000	5.8%
ERP Business Analyst	$ 95,000 - $ 125,250	$ 99,750 - $ 131,750	5.1%
ERP Technical/Functional Analyst	$ 98,000 - $ 142,750	$ 103,000 - $ 149,250	4.8%
ERP Technical Developer	$ 102,500 - $ 145,000	$ 107,500 - $ 152,500	5.1%
Lead Applications Developer	$ 100,750 - $ 134,000	$ 105,750 - $ 143,250	6.1%
Mobile Applications Developer	$ 93,000 - $ 132,000	$ 99,750 - $ 143,500	8.1%
Technical Writer	$ 51,750 - $ 82,500	$ 53,000 - $ 83,750	1.9%

(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 7%
C++ development skills 5%
Hyperion skills 3%

Java development skills 6%
Java EE/J2EE development skills 5%
LAMP (Linux, Apache, MySQL and
  Perl/PHP/Python) skills 7%
.NET development skills 7%
PHP development skills 7%
SAP development skills 6%
SharePoint skills 9%

All salaries listed on Pages 12-15 are in Canadian dollars.

Title	2015	2016	% Change
Consulting & Systems Integration			
Director	$118,750 - $160,250	$123,250 - $167,750	4.3%
Practice Manager	$103,500 - $152,500	$108,000 - $158,750	4.2%
Project Manager/Senior Consultant	$ 99,250 - $149,000	$103,000 - $157,500	4.9%
Staff Consultant	$ 63,750 - $ 88,500	$ 66,750 - $ 93,000	4.9%
Senior IT Auditor	$114,000 - $175,000	$119,000 - $184,250	4.9%
IT Auditor	$ 90,750 - $117,000	$ 94,500 - $123,000	4.7%
Data/Database Administration (b)			
Big Data Engineer	$109,000 - $139,250	$117,000 - $150,500	7.8%
Database Manager	$105,500 - $146,500	$110,500 - $156,250	5.9%
Database Developer	$ 90,250 - $120,750	$ 96,000 - $126,250	5.3%
Database Administrator	$ 85,000 - $115,500	$ 90,000 - $120,250	4.9%
Data Analyst/Report Writer	$ 74,500 - $104,000	$ 78,500 - $110,000	5.6%
Data Architect	$111,000 - $149,750	$116,000 - $160,500	6.0%
Data Modeler	$ 94,000 - $121,750	$ 99,000 - $130,000	6.1%
Data Scientist	$ 92,750 - $113,750	$ 96,750 - $127,250	8.5%
Data Warehouse Manager	$103,000 - $141,250	$105,000 - $150,500	4.6%
Data Warehouse Analyst	$ 95,000 - $131,000	$ 98,250 - $138,500	4.8%
Business Intelligence Analyst	$ 89,000 - $120,000	$ 94,750 - $127,250	6.2%
Electronic Data Interchange (EDI) Specialist	$ 73,750 - $101,500	$ 77,750 - $106,750	5.3%
Portal Administrator	$ 73,750 - $100,750	$ 75,500 - $104,250	3.0%
Quality Assurance (QA) & Testing (c)			
QA Engineer – Manual	$ 70,000 - $ 92,500	$ 72,250 - $ 95,000	2.9%
QA Engineer – Automated	$ 75,500 - $ 99,750	$ 78,000 - $102,750	3.1%
QA/Testing Manager	$ 84,750 - $109,750	$ 88,000 - $113,500	3.6%
QA Associate/Analyst	$ 69,750 - $ 94,750	$ 71,750 - $ 97,500	2.9%

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

ETL skills..6%
Microsoft SQL Server database skills..............8%
Oracle database skills..............................7%

(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%

Title	2015	2016	% Change
Web Development (d)			
Senior Web Developer	$ 95,000 - $124,750	$100,250 - $132,000	5.7%
Web Developer	$ 69,000 - $102,750	$ 76,750 - $105,000	5.8%
Front-End Web Developer	$ 70,000 - $ 95,000	$ 75,250 - $ 99,750	6.1%
Web Administrator	$ 67,500 - $ 89,750	$ 70,000 - $ 94,250	4.5%
Web Designer	$ 71,000 - $102,750	$ 78,000 - $106,250	6.0%
E-Commerce Analyst	$ 74,250 - $106,000	$ 79,750 - $110,750	5.7%
Networking/Telecommunications (e)			
Network Architect	$101,250 - $152,000	$105,750 - $161,000	5.3%
Network Manager	$ 87,750 - $116,250	$ 92,000 - $122,000	4.9%
Network Engineer	$ 88,250 - $116,500	$ 93,500 - $123,000	5.7%
Wireless Network Engineer	$ 94,500 - $127,250	$104,000 - $136,000	8.2%
Network Administrator	$ 70,500 - $ 94,250	$ 75,000 - $ 99,000	5.6%
Pre-Sales Engineer/Technical Engineer	$ 92,000 - $117,750	$ 97,500 - $123,000	5.1%
Telecommunications Manager	$ 93,250 - $121,250	$ 97,500 - $126,500	4.4%
Telecommunications Specialist	$ 66,000 - $ 92,500	$ 68,750 - $ 96,250	4.1%
Operations			
Manager	$ 80,000 - $ 96,250	$ 82,250 - $ 99,000	2.8%
Computer Operator	$ 43,250 - $ 55,750	$ 43,500 - $ 57,250	1.8%
Mainframe Systems Programmer	$ 65,750 - $ 91,250	$ 66,500 - $ 93,000	1.6%

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

AJAX (Asynchronous JavaScript and XML) development skills 3%
ASP development skills.............................. 4%
C# development skills 7%
ColdFusion development skills 3%
Content management system (CMS) skills 6%
DCOM/COM/ActiveX development skills 3%
Java development skills.............................. 6%
Java EE/J2EE development skills 5%
LAMP (Linux, Apache, MySQL and Perl/PHP/Python) skills 7%
.NET development skills 7%

PHP development skills 7%
Python skills 5%
Ruby on Rails skills................................... 6%
SharePoint skills 9%
Virtualization skills 8%
Web services development skills................... 8%

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

Cisco network administration skills 7%
Linux/Unix administration skills 7%
Voice over Internet Protocol (VoIP) administration skills........................ 6%
Windows 7 skills 4%

All salaries listed on Pages 12-15 are in Canadian dollars.

Title	2015	2016	% Change
Security (f)			
Data Security Analyst	$ 98,000 - $148,000	$105,250 - $157,250	6.7%
Systems Security Administrator	$ 87,000 - $120,000	$ 92,000 - $127,250	5.9%
Network Security Administrator	$ 94,500 - $130,000	$ 98,500 - $138,500	5.6%
Network Security Engineer	$ 99,750 - $133,750	$106,000 - $142,250	6.3%
Information Systems Security Manager	$110,500 - $145,250	$115,250 - $152,500	4.7%
Software Development (g)			
Product Manager	$105,250 - $139,750	$110,750 - $147,000	5.2%
Software Engineer	$ 90,750 - $132,000	$ 95,500 - $140,000	5.7%
Software Developer	$ 76,000 - $116,500	$ 82,750 - $122,500	6.6%
Technical Services, Help Desk & Technical Support (h)			
Manager	$ 86,250 - $116,000	$ 90,250 - $122,750	5.3%
Desktop Support Analyst	$ 57,000 - $ 79,000	$ 59,250 - $ 82,500	4.2%
Systems Administrator	$ 68,250 - $ 94,500	$ 72,000 - $ 99,250	5.2%
Systems Engineer	$ 81,000 - $104,000	$ 85,000 - $110,500	5.7%
Messaging Administrator	$ 69,750 - $ 90,750	$ 73,000 - $ 95,000	4.7%
Help Desk Tier 3	$ 66,750 - $ 88,250	$ 69,750 - $ 93,250	5.2%
Help Desk Tier 2	$ 53,750 - $ 65,500	$ 55,000 - $ 69,000	4.0%
Help Desk Tier 1	$ 41,250 - $ 53,250	$ 43,250 - $ 55,000	4.0%
Instructor/Trainer	$ 57,750 - $ 78,250	$ 59,750 - $ 80,750	3.3%
PC Technician	$ 48,000 - $ 67,750	$ 50,000 - $ 70,750	4.3%
Business Continuity Analyst	$ 78,250 - $113,500	$ 82,000 - $118,250	4.4%

(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 7%
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 7%
C++ development skills 5%
DCOM/COM/ActiveX development skills 3%
Hadoop skills 7%

Java development skills 6%
Java EE/J2EE development skills 5%
.NET development skills 7%
PHP development skills 7%
Web services development skills.................... 8%

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

Basis administration skills............................ 3%
Cisco network administration skills 7%
HDI certifications....................................... 5%
Linux/Unix administration skills 7%
Virtualization skills 8%
Windows 7 skills 4%

Local Variances

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.

UNITED STATES

ALABAMA
Birmingham. 95.0
Huntsville. 93.0
Mobile. 86.0

ARIZONA
Phoenix. 112.0
Tucson. 103.5

ARKANSAS
Fayetteville. 95.0
Little Rock 95.0

CALIFORNIA
Fresno. 90.0
Irvine 128.0
Los Angeles 128.0
Oakland 127.0
Ontario. 117.0
Sacramento. 102.0
San Diego. 123.0
San Francisco 138.0
San Jose 135.0

Santa Barbara 127.0
Santa Rosa 118.1
Stockton 85.0

COLORADO
Boulder 116.3
Colorado Springs. 92.3
Denver 104.8
Fort Collins 95.0
Greeley. 86.0
Loveland 92.0
Pueblo. 80.0

CONNECTICUT
Hartford 116.5
New Haven 112.0
Stamford 131.0

DELAWARE
Wilmington 105.0

DISTRICT OF COLUMBIA
Washington 133.0

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.

FLORIDA
Fort Myers 90.0
Jacksonville 95.0
Melbourne. 90.5
Miami/Fort Lauderdale. . 107.0
Orlando 99.5
St. Petersburg. 96.5
Tampa. 98.0
West Palm Beach 100.5

GEORGIA
Atlanta 106.5
Macon 84.0
Savannah 84.0

HAWAII
Honolulu 105.0

IDAHO
Boise. 86.1

ILLINOIS
Chicago 123.0
Naperville 112.0
Rockford 83.0
Springfield. 91.0

INDIANA
Fort Wayne 82.0
Indianapolis 96.0

IOWA
Cedar Rapids 94.0
Davenport. 95.0
Des Moines 100.0
Sioux City 83.0
Waterloo/Cedar Falls. . . . 87.0

KANSAS
Overland Park 99.2

KENTUCKY
Lexington 91.5
Louisville 92.0

LOUISIANA
Baton Rouge 99.0
New Orleans. 99.0

MAINE
Portland 95.0

MARYLAND
Baltimore 103.0

MASSACHUSETTS
Boston. 133.0
Springfield. 104.0

MICHIGAN
Ann Arbor 101.5
Detroit. 100.0
Grand Rapids 85.5
Lansing 85.0

MINNESOTA
Bloomington 105.5
Duluth. 79.6
Minneapolis. 106.0
Rochester 100.5
St. Cloud 82.0
St. Paul 102.0

MISSOURI
Kansas City 99.2
St. Joseph 91.0
St. Louis 100.0

NEBRASKA
Lincoln 86.0
Omaha. 96.0

NEVADA
Las Vegas 97.0
Reno 98.0

NEW HAMPSHIRE
Manchester/Nashua. . . . 112.0

NEW JERSEY
Mount Laurel 115.0
Paramus 130.0
Princeton 125.0
Woodbridge 126.5

NEW MEXICO
Albuquerque 91.5

NEW YORK
Albany 97.0
Buffalo 95.0
Long Island 120.0
New York 140.0
Rochester 91.7
Syracuse 90.3

NORTH CAROLINA
Charlotte 101.5
Greensboro 100.0
Raleigh 104.0

OHIO
Akron 89.0
Canton 82.0
Cincinnati 97.5
Cleveland 96.0
Columbus 97.5
Dayton 87.0
Toledo 84.5
Youngstown 76.0

OKLAHOMA
Oklahoma City 93.0
Tulsa 93.0

OREGON
Portland 106.5

PENNSYLVANIA
Harrisburg 95.0
Philadelphia 115.0
Pittsburgh 98.0

RHODE ISLAND
Providence 97.0

SOUTH CAROLINA
Charleston 93.5
Columbia 93.5
Greenville 92.0

TENNESSEE
Chattanooga 89.0
Cool Springs 99.0
Knoxville 89.0
Memphis 95.0
Nashville 99.5

TEXAS
Austin 107.0
Dallas 108.5
El Paso 72.0
Fort Worth 107.5
Houston 107.5
Midland/Odessa 115.0
San Antonio 100.0

UTAH
Salt Lake City 101.0

VIRGINIA
Norfolk/Hampton Roads . . 96.0
Richmond 98.0
Tysons Corner 132.0

WASHINGTON
Seattle 118.9
Spokane 82.0

WISCONSIN
Appleton 85.0
Green Bay 86.5
Madison 98.5
Milwaukee 101.0
Waukesha 99.0

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

Hiring Outlook for Canada

Both full-time and contract employment opportunities are expected to rise in the year ahead as more employers pursue cloud computing and big data initiatives. Technology, manufacturing, healthcare, web services, Software as a Service and property development companies are likely to be among the leading employers hiring.

Similar to U.S. firms, Canadian employers are searching for highly skilled applications developers, including mobile app developers and web developers, as well as business analysts and desktop support professionals. Candidates with .NET and SharePoint skills are in especially high demand.

CANADA

ALBERTA
Calgary. 104.8
Edmonton 102.9

BRITISH COLUMBIA
Fraser Valley 98.4
Vancouver 103.9
Victoria 96.2

MANITOBA
Winnipeg 90.5

ONTARIO
Kitchener-Waterloo. 95.8
Ottawa 100.2
Toronto 104.9

QUEBEC
Montreal 102.9
Quebec City 90.0

SASKATCHEWAN
Regina 93.9
Saskatoon 95.3

Technical Skills + Soft Skills = In-Demand IT Pros

More employers are looking for the whole package when hiring IT professionals for their teams – candidates with a solid mix of technical and soft skills. Here are some of the most common soft skills IT leaders are seeking:

- **Communication:** Speaks to both technical and nontechnical audiences with ease.

- **Problem-solving:** Understands complex business issues and how to solve them through technology.

- **Collaboration:** Leverages the strengths and unique perspectives of others within the organization and works with all stakeholders to reach a solution.

- **Team-oriented:** Works effectively and thrives as a member of various work groups to bring greater value to the overall organization.

- **Creative:** Finds new and innovative approaches to performing the business at hand.

HOT CERTIFICATIONS

Many employers no longer request that candidates have certain credentials – they require them. Certifications in demand include:

- **Cisco certifications:** Cisco Certified Network Associate (CCNA), Cisco Certified Networking Professional (CCNP)

- **Microsoft certifications:** Microsoft Certified Professional (MCP), Microsoft Certified IT Professional (MCITP)

- **Project management certifications:** Project Management Professional (PMP)

- **Security certifications:** Certified Information Systems Security Professional (CISSP)

- **Virtualization certifications:** VMware Certified Professional (VCP)

Glossary of Job Descriptions

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 and 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, in addition to 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

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, in addition to an ability to identify and propose new IT business processes. Other

desired characteristics include leadership and organizational, analytical 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, 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, a background in applications development and five or more years of experience managing complex projects. Project management certifications, such as those from the 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, and 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 enterprisewide application design standards are maintained

• Collaborating with other stakeholders to ensure the 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.

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- or business-related discipline is typically required, as is thorough knowledge of the employer's existing CRM applications.

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 through 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 and 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

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
- 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 projects 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 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, the ability to monitor and manage multiple initiatives concurrently, and excellent staff management skills. Employers often seek a master's degree, such as an MBA, or other relevant graduate degrees. 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 management. At a minimum, a bachelor's degree in business or an IT-related field is required, and

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. They also need 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 experience with 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 extensive 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 desired. Experience with NoSQL is 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 the 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 is often 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 is also 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 are also 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 SCIENTIST

Data scientists must have a range of mathematical and analytical skills, as well as business acumen. Big data scientists analyze and integrate multiple data sets and make recommendations based on their findings. Experience in programming languages – commonly Python or Java – is often required, as is a Ph.D.
Typical duties include:

- Gathering and processing raw data
- Providing analysis to leaders in order to support business decisions
- Developing metrics and prototypes that can be used to drive business decisions
- Identifying emerging trends and opportunities for business growth

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 often 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

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 QA 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 documenting 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, organizational 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 information 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 practices and defining benchmarks and measures
- Preparing budget and staffing plans and recommendations
- Ensuring proper coordination and collaboration with technical teams

QA ASSOCIATE/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 combined 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. Candidates 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 environment and mentoring junior colleagues. Sample code and web links to sample work are often requested. Employers normally seek a bachelor'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 development, 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 knowledge 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 individuals 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 developing specifications for web-based applications
- Providing technical assistance to web administrators
- Integrating websites with back-end systems such as databases
- Writing test plans and test results

FRONT-END WEB DEVELOPER

Front-end developers create web- and mobile-based applications and work on website maintenance and enhancements. Front-end developers code, design and edit layout and functionality of websites. Both technical and creative skills, as well as strong communication skills, are needed for this role. Experience with CSS preprocessors like Sass and JavaScript is necessary, and libraries, like jQuery, are typically preferred.

Typical duties include:
- Creating web- and mobile-based applications
- Managing website maintenance and enhancements
- Coding, designing and editing the layout and functionality of websites

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 is also 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 is also 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, accompanied by at least seven years of experience with network operating systems such as Cisco, Novell and Windows Server. Network architects should also 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
- Providing reports to IT management regarding network system performance, utilization and compliance
- Managing and mentoring a staff of network technicians

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 Internetwork 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

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. Though 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 as the technical expert in customer presentations
- 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 troubleshooting 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 is often 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 is also a valuable asset.

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
- Preventing and detecting intrusion
- Performing intrusion detection analysis

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, are also 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 and 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. Though 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

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
- Deciding whether 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 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, can also 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 required.

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, are 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

About Robert Half Technology

Robert Half Technology is much more than a resource for compensation data. We offer a full spectrum of technology staffing solutions to meet our customers' project, contract-to-full-time and full-time IT recruitment needs. In 2015, our parent company, Robert Half, again was named to FORTUNE® magazine's "World's Most Admired Companies" list, ranking #1 in our industry.

(March 1, 2015)

Robert Half Technology offers project, contract-to-hire and full-time staffing, as well as managed IT service solutions and IT solution consulting, worldwide to organizations that require on-demand technical expertise. The following business functions are representative of the technology project services we offer:

- **Project consultants**: With a database of more than 1 million experienced consultants, we are able to quickly provide you with the skilled candidates you need to help meet your project staffing requirements.

- **Contract-to-hire and full-time staffing**: We designed an innovative Company-In® recruitment process to help companies accelerate their hiring and minimize the loss of time and money associated with staffing open positions.

- **Salaried professional service***: We can offer you access to a wide range of highly skilled technology professionals for long-term projects that require ongoing expertise without turnover.

- **IT managed services**: We have the ability to scale for large projects regionally, nationally and globally, including PC refreshes, OS upgrades, help desk/desk-side support outsourcing, and QA testing.

- **Solution consulting**: We deliver joint solutions in collaboration with Robert Half's subsidiary, Protiviti, a global consulting and internal audit firm. Together, we can offer subject-matter experts who have experience providing highly complex, deliverables-based consulting using Protiviti's proprietary methodology and tools.

Available only in the United States.

BENEFITS OF USING PROJECT CONSULTANTS

- Relief for overburdened employees at risk of burnout – or leaving your firm altogether

- Minimized overtime expenses

- Reduced recruiting and hiring costs

- Support for core employees temporarily dedicated to special initiatives but whose regular jobs can't go unattended

- Greater job stability for full-time workers who'll be largely protected from cycles of hiring and layoffs as business needs fluctuate

Worldwide Locations

United States

Arizona
Phoenix

California
City of Industry
Irvine
La Jolla
Los Angeles
Oakland
Ontario
Sacramento
San Francisco
San Jose
San Mateo
Stockton
Torrance
Westwood

Colorado
Colorado Springs
Denver
Englewood

Connecticut
Hartford
Stamford

District of Columbia
Washington

Florida
Coral Gables
Fort Lauderdale
Jacksonville
Orlando
Tampa
West Palm Beach

Georgia
Atlanta

Illinois
Chicago
Hoffman Estates
Oakbrook Terrace

Indiana
Indianapolis

Iowa
Cedar Rapids
Des Moines

Kansas
Overland Park

Kentucky
Louisville

Louisiana
New Orleans

Maryland
Baltimore
Bethesda

Massachusetts
Boston
Burlington
Westborough

Michigan
Grand Rapids
Southfield

Minnesota
Bloomington
Minneapolis

Missouri
St. Louis

Nevada
Las Vegas

New Hampshire
Manchester

New Jersey
Parsippany
Princeton
Saddle Brook
Woodbridge

New Mexico
Albuquerque

New York
New York – Midtown
New York – Wall Street
Uniondale

North Carolina
Charlotte
Raleigh

Ohio
Akron
Blue Ash
Cincinnati
Cleveland
Columbus
Dayton
Dublin

Oklahoma
Oklahoma City
Tulsa

Oregon
Portland

Pennsylvania
King of Prussia
Philadelphia
Pittsburgh

Rhode Island
Providence

South Carolina
Charleston
Greenville

Tennessee
Memphis
Nashville

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

Utah
Salt Lake City
Thanksgiving Point

Virginia
Richmond
Tysons Corner

Washington
Bellevue
Seattle

Wisconsin
Madison
Milwaukee

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Paris – La Défense
Stade de France

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London Central
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2884 Sand Hill Road
Menlo Park, CA 94025
1.877.336.4854
rht.com

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