

Careers in Technology

How to Find Your Job in Tech

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Job Search Basics

Job hunting can be stressful, demoralizing and frustrating unless you understand the different stages of the hiring process. When you do, you'll be able to focus on the activities that yield the best return for your time. The items in this section make up our guide to navigating the process without going crazy. And believe us, when you're talking to possible employers, you want to be sane.

How Companies Find Candidates

When you apply for a job, the process usually works like this: Recruiters screen resumes, conduct phone interviews and present the top candidates to the hiring manager.

But even if you do everything right when you respond to a job posting, don't assume you've got the best shot. A survey of large employers by recruiting advisors CareerXroads showed that referrals accounted for a whopping 28 percent of successful candidates in 2011. So it's obvious that networking is a hugely effective way to find work. In fact, researching the market, targeting specific employers and networking increases your chances of success by 15 to 25 percent.

On top of that, having an insider recommend you or forward your resume to the hiring manager helps you circumvent the keyword-matching software that Human Resources uses to select resumes from the applicant database.

So how do you break through?

Survival Tips

- **Create and post** a grammatically correct, keyword-rich resume and use search agents to find suitable employers and positions.
- **Coordinate your resume** with your online profiles and refresh them weekly.
- **Customize** your resume and cover letter for each position and company you apply to.
- **Use a professional sounding** email address and voicemail greeting.
- **Search yourself** on the Internet and scrub inappropriate content from social media sites.
- **Build your brand** by blogging and joining professional organizations. Some 86 percent of employers in a Microsoft survey said that having a positive online presence influences a candidate's reputation.
- **Follow-up.** Candidates who follow up have a much greater chance than people who don't. It only takes a few emails and phone calls.

What Interviewers Expect

For most positions, companies usually conduct two or three face-to-face interviews and pare down the number of contenders after each round. To advance, you don't have to satisfy every one of the technical requirements, because IT managers gravitate toward passionate, prepared candidates who fit the culture and work environment.

So: Research the company, job description and interviewer before your meeting. Use what you find out to anticipate questions and formulate example-laden answers. This kind of preparation and practice improves your survival rate by a full third.

Survival Tips

- **Wear conservative** business or business casual attire that mirrors the company's culture.
- **Research and practice** effective techniques for technical, group and behavioral interviews.
- **Send a thank you** note or email to everyone you meet.
- **Ask for feedback** and express interest by following up every week.

Preparing for Their Offer

Nine out of 10 companies will check your references and conduct a background investigation once they've extended a conditional offer. So, avoid surprises by touching base with your references and clearing up any discrepancies before you get to this stage. Also, you may have to take a drug test, pass a physical or provide copies of your college transcripts or technical certifications.

While you probably won't have the ability to negotiate a significantly higher salary, this is a great time to ask about future raises and performance reviews.

Survival Tips

- **Pull copies** of your transcripts, DMV records, credit reports and, if necessary, criminal records, and be prepared to explain any issues.
- **Avoid problems** by being completely honest in resumes and job applications.
- **Research and practice** effective salary negotiation techniques. But you should ascertain your market value before launching your search.
- **Bring proof** of your ability to work in the U.S. and other requested documentation so you can accept an offer on the spot and complete the new hire paperwork.

Job Search Tactics

Why You Need a Strategy

Every day, thousands of new graduates armed with great resumes, cover letters, references and portfolios launch the most important campaign of their careers — with no idea where they're headed. As a result, they often end up with little to show for their efforts.

Having a great resume and online profile is important, but think of them as tactics, the on-the-ground approach to your job search. Each one of them is key, but it's your strategy that unites and strengthens them to be more effective.

As good as your resume and networking skills may be, they're infinitely more effective when applied deliberately and within the context of a plan. As the Chinese author Sun Tzu wrote in *The Art of War*: "Strategy without tactics is the slowest route to victory; tactics without strategy is the noise before defeat."

Everything from your daily job-hunting activities to how you present yourself — online and in the real world — should flow from a comprehensive, flexible plan that targets specific industries and companies that match your talents, objectives and contacts.

Start by creating an inventory of your strengths and skills, then research the market to create an initial target list of about 50 companies who are actively hiring and need your skills. From there, tailor your resume, cover letter and interview talking points to show prospective employers that you understand their business needs — and why your expertise is exactly what they need.

Whether you network, apply online or use a recruiter, your strategy should determine the message you convey through documents, emails and face-to-face meetings. Remember, tactics are how strategies are executed, but it's the strategy that maximizes your efforts — and your chances of scoring the job you want.

The tactics we describe in this section — resumes, cover letters, preparing for interviews and the like — are all about executing your strategy. Develop your theme, and carry it across your efforts. The uncomfortable secret of job hunting is that most people don't do this. That's why a comprehensive approach increases your odds.

How to Network in IT

There's a widespread myth about networking that you may have heard: It's like a parlor game built around trading business cards. Attend a variety of business/social events, press the flesh, make a few good impressions, and presto! A newfound acquaintance will refer you — or even introduce you — to someone who's interviewing candidates for your dream job.

Of course, it's never that easy.

One reason people have difficulty networking is they don't appreciate what hard work it is. Networking with strangers is hardest of all. Advancing from a new acquaintance to a potential job referral usually means cycling through multiple levels of contacts (one refers you to another, who then refers you to another, and so on) and informational interviews — whose only return on your time invested may be the opportunity to secure yet another informational interview with a next-in-line contact.

Even when networking with people you already know, success requires tenacity, creativity, a willingness to take chances and a willingness to do favors for others.

However challenging it is, effectively building a network of professional contacts is essential to your career. The good news: Even if glad-handing isn't your style, there are several ways to make it more comfortable.

Our Tips on Networking

- **Don't try to become a master overnight.** Instead, take baby steps. If networking hasn't been a regular part of your life, take it slowly and build confidence.
- **Don't assume you're bothering people.** Most will be glad to hear from you based on a mutual contact, friend or colleague.
- **Rely on your supporters.** Network first with mentors, close colleagues and friends.
- **Remember all the times** when you have been successful in other group endeavors.
- **Try to take a colleague,** friend or manager to meetings or conferences so you'll know at least one person there.
- **Don't underestimate the power of listening.** It's a valuable and appreciated talent.
- **Make the most of what you know.** Take the time to read an industry newsletter in advance of attending a business/social event or in preparation for an informational interview with a contact, so that you will be comfortable sharing the tidbits you have learned.
- **Develop a well-crafted pitch,** focused on your goal and what you bring to the table.
- **Rehearse, rehearse, rehearse.** Many people get tongue-tied when meeting someone new, so practice what you plan to say.
- **If you have news or a problem to solve,** try picking up the phone and telling someone else about it.
- **Attend events that have a purpose.** If you're uncomfortable at gatherings set up solely for networking, try to attend those that have a purpose — listening to a speaker, for example — since they tend to have a planned agenda.
- **Reach out as often as you can,** using the phone or sending an e-mail.
- **Try to get out of the office.** It helps to get away from your desk, get out of your comfort zone, and walk around. Almost all encounters are worthwhile.

Networking by the Numbers

Networking is a critical component of your job search, because referrals are still the number one source of new hires. Nearly half of all employers make at least one hire for every five referrals they get, according to a survey by consulting firm CareerXroads.

Another survey, by recruiting software company JobVite, found that 65 percent offer employees bonuses or other perks if one of their referrals is hired. Because internal candidates are filling fewer jobs than in previous years, companies need to tap external sources to fill their open positions.

Another finding: Nearly 46 percent of large companies source most of their hires from job-board postings, while about 30 percent find an equal number from postings and database searches.

Then there are your social profiles: Eighty-six percent of recruiters are likely to look at them. More than half look unfavorably upon posts mentioning drugs, sex, profanity or containing spelling or grammar errors. Forty-seven percent say it hurts you if you've posted pictures involving alcohol consumption.

Our Conclusions

- Networking is important to a successful job search.
- Social media is a great way to network as long as you use it wisely.
- Companies still rely on job postings, especially for highly skilled candidates like IT professionals.

Cover Letter Basics

Here's the problem: Career professionals say you need both a resume AND a cover letter to be effective. But hiring managers beg to differ. They're busy and just want to see what experience you bring to the table. So, many of them don't spend much — if any — time on cover letters.

Still, you shouldn't just decide that cover letters aren't important. A well-crafted letter that gets a manager's attention right off the bat and makes a good case for your talents can separate you from everyone else. Many of the same managers who grumble about their time still like to see applicants who go the extra mile.

What You Need

Your cover letter should be a maximum of four paragraphs that summarize the value you offer and makes the manager want to read your resume. It should showcase your technical knowledge and your problem-solving and communication skills, which are increasingly critical requirements for IT jobs.

Making Them Work

When emailing a cover letter, use the job title and/or reference number as the subject line. In the first sentence, mention the position you're applying for. Then go beyond the information in your resume by explaining why you want the job and what you offer the company. In other words, take this as an opportunity to tell them why you're the best person to fill this particular vacancy.

If you're responding to a posted job opening, try to determine the types of problems the company wants to solve, and lay out what you can do to help them. That's a key part of the equation.

Also, if someone at the company has referred you for the position, or if you've previously met the person to whom you're sending the letter, be sure to mention it prominently.

Nuts and Bolts

Format your cover letter as a business letter, with both a salutation and a signature.

Double-check everything. Triple-check that you've spelled the addressee's name correctly. Remember, the cover letter is a way for the hiring manager to assess your soft skills, attention to detail and interest in the position. Oh, and did we say double-check everything and triple-check that you've spelled the addressee's name correctly?

Cover letters aren't one-size-fits-all. If you're applying for multiple jobs simultaneously, craft each letter separately, customizing it to the particular position and company. It's a pain, but you have to. Sending out the same letter and resume to 20 different companies doesn't do you any favors.

Cover Letters: A Manager's Tips

Matt Jones, senior mobile Web content manager at eBay/PayPal, says the cover letters he responds to have these qualities:

- **Genuine personality.** Don't offer "stiff" and prepackaged clichés. Instead, explain why you want the job.
- **Realistic interest.** Don't make over-the-top promises. Rather, suggest what you can accomplish in your first 90 days
- **Concrete citations** of current relevant work. Match your accomplishments to the job description.
- **Evidence** that you have researched the role and the company. "Refer to something you read that you liked about what the company has done well."
- **Mention any peers or mentors** within the company, or the immediate field, who have encouraged you to apply. It's a way of providing a quick, up-front reference.
- **Listing of legitimate abilities**, competencies and certificates. Highlight your major tech skills and special tool use, such as design software, content management systems, analytic tools and Web platforms.
- **Mention of any tech awards** or recognized innovations by respected organizations.
- **Links, links, links** to digital media. "This helps the reviewer quickly, if at a glance, see real-world examples of your talents, awards or references." Just make sure the information in your cover letter matches your resume, online profile and professional portfolio.

Finally Jones says, "Offer to provide additional credentials or work samples, or to take tests as may be required. Or point to your own website, if that's pertinent."

Resume Basics

At their core, resumes are marketing documents that connect your skills and experience to employers' needs. So as you create yours, think of yourself as a marketing director: Research the target audience, brainstorm ideas, and develop a marketing and communications strategy before you start writing.

The Basics

The first step is to review resume samples on Dice (see them at <http://news.dice.com/dices-library-of-free-sample-resumes/>) or through your campus career center. Select a simple design that lists your education and coursework before your experience, and includes a section for computer languages, operating systems and other technical expertise.

It's best to create a Microsoft Word document that converts easily to plain text. When you need a printed version, always use quality 8 1/2-by-11 white bond paper and use no more than two font types, preferably 12-point Times New Roman or Arial. Use bold type or bullets only to emphasize key points.

Next, choose resume action verbs. For ideas, check out (<http://news.dice.com/power-verbs-for-your-resume-and-cover-letter/>).

Finally, have handy all pertinent information. Your resume needs to be accurate, so refer to a recent transcript for your GPA, and a course catalog so you can include the titles and descriptions of key technical courses. You'll also need a list of your student projects, internships, awards, extracurricular activities and the exact dates of paid or volunteer positions.

Research

Print out the job descriptions for your targeted positions. Highlight keywords describing the skills, competencies and traits required by each employer. These include job titles, software program titles, hardware names, soft skills and attributes like strong communications skills, teamwork and problem-solving capabilities — even industry buzzwords.

Then pepper your resume with these because employers use an algorithm to select candidates based on keyword matches. In fact, make sure your resume is search engine friendly so employers can find it online.

Be sure to research the industries you want to work in so you can understand their dynamics. Ask yourself how you can provide appropriate solutions. Put yourself in the employer's shoes and think about what kind of person you'd want to hire to deal with their challenges.

Finally, map your experience, skills and attributes to the employer's needs and requirements, and highlight them. Remember, do this each time you apply somewhere. Customization is critical.

Resume Writing Guidelines

Use these guidelines to create your resume:

An objective statement is optional, but it's most effective when your goal includes a specific job title.

Begin with a two- to three-sentence personal branding statement, followed by a short qualifications summary. This is your marketing pitch. It states the value you offer and gives reviewers a preview of what's to come.

Next list your relevant jobs, student projects and internships, beginning each with one or two sentences describing the challenges you faced and the specific results you achieved.

Distinguish yourself. Say what you know, but be sure to talk about what you've done and how well you did it.

Provide a series of accomplishment statements for each job, illustrating how you achieved results. Begin each statement with a past tense action verb and choose examples that demonstrate proficiency with the required skills.

Incorporate links to your website, portfolio and profiles on social media sites.

Include your overall or major GPA if it's 3.0 or higher, as well as your anticipated or actual graduation date.

Capitalize proper nouns and words that begin sentences or phrases. Use periods only at the end of complete sentences and use punctuation consistently throughout the document.

Use "I" only in your objective statement. First person is implied in resumes.

Limit length to no more than two pages. Some say even that's long for a new graduate.

Spell check and grammar check, and also ask two professionals you trust to proofread and evaluate whether you've been effective.

Interviews: How to Prepare

You don't have to satisfy every one of a job description's technical requirements to score an offer. The reason: IT managers prefer passionate, prepared candidates who fit the culture and work environment. Once you've gotten past the resume stage, the trick is to prepare for your interview as if you were already inside. Here's what you do.

Step 1: Study Up

You need to understand the company's culture, values, competitive advantages and business challenges. Start by studying its website, annual reports and news releases, and peruse comments you find on sites like Glassdoor or in a Google search.

Ask HR for the interviewers' names and titles. Search for them so you can reference mutual interests and contacts when you meet.

Investigate the salaries and market demand for entry-level employees in your field so you don't get flustered when the interviewer asks about compensation.

Finally, prepare for technical questions by reviewing the job requirements and memorizing the correct answers in certification exams.

Step 2: Create Talking Points

It's hard to think on the fly, so prepare your thoughts in advance so you can more easily answer any kind of interview question they throw at you. Create an inventory of examples, vignettes and key facts so you can illustrate your experience in ways that meet the job's technical and non-technical requirements.

Also, prepare a list of questions to ask the interviewer. The session shouldn't be a one-way street.

Finally, anticipate and be ready to address any concerns, especially if you have a low GPA or lack hands-on experience.

Step 3: Rules of Engagement

Arrive 10 to 15 minutes before your interview and remember to bring 10 copies of your resume, plus coding samples and portfolio, a pen and notepad, the interviewer's contact information, your reference list and change for the parking meter.

Turn off your cell when you reach the lobby and don't chew gum or sip coffee. Match the interviewer's grip when shaking hands, make eye contact and sit up straight, listen, nod and occasionally smile. Engender a connection by matching the manager's intensity, tone and style, and inject company lingo into the conversation or reference the job description when you can.

Finally, ask for feedback and emphasize your interest in the job. These things will help you gauge the manager's interest and determine the next step in the process.

Step 4: Follow-Up

Get business cards from everyone you meet and send them follow-up emails or notes within 24 hours. Be sure to reference something you discussed, or include a link to a relevant article or blog post. Continue following up until you get a definitive answer on your status. Prepare for subsequent interviews by reviewing your notes, coming up with new questions and addressing any of the interviewer's lingering concerns.

Step 5: Avoid Fatal Errors

Employers are being incredibly picky these days, to the point where committing any one of these mistakes could blow the whole deal.

- **Lying:** It's better to say you don't know something than to pretend you do. And don't lie about your experience ever, since employers can rescind an offer if they find out.
- **Arguing:** Don't argue with interviewers even if you disagree with their technical answers or solutions.
- **Being Negative:** Don't speak poorly about a former employer, boss or colleague.
- **Being Disrespectful:** Be respectful and avoid tech speak when talking with recruiters or HR managers. They may not make the final selection, but they certainly influence it.

Experience: Where to Get it

Getting hands-on experience may not be as hard as you think, because employers are looking for a broad range of attributes, many of which can be acquired while you're still in school. These are things like team work, leadership abilities, written communication skills, problem-solving skills and a strong work ethic.

Where to find the experience? Think about these.

Technical Internships

Employers prefer to hire people who have relevant work experience, which often comes through an internship or co-op assignment. If you can't get one through the campus career center, try networking.

Student Co-Ops

Cooperative education programs are partnerships among employers, students and a school. They're designed to provide on-the-job training, college credit and, in most cases, some kind of pay.

Projects

Besides providing hands-on technical experience, student or class projects give you the chance to develop teamwork and problem-solving skills. So, choose classes where projects are part of the curriculum.

Freelance Work

"Co-ops or internships are ideal, but students can also acquire hands-on experience just by freelancing," says one recruiter. "Some even start their own companies. It doesn't matter how you get the experience, just that you have it."

Some added benefits: Because you have to solicit your own gigs and then deliver the results to clients on time, freelance work also develops initiative, your work ethic, reliability and marketing skills.

Research Assistantships

Instructors often take on outside projects or conduct research for outside companies and engage research assistants to help them. Also, consider joining technical organizations like IEEE, the Institute of Electrical and Electronics Engineers. You may be able to land internships or projects by networking with company reps who attend these groups' meetings.

Volunteer

Offer your services to non-profit and community organizations, local political campaigns or entrepreneurs. They often need help with a donor or customer database or Web design project, and they don't have the funds to hire experienced consultants.

Virtual Experience

Use free software to set-up a virtual lab on your PC, then teach yourself new skills in a simulated environment. Working with open source is a great way to acquire experience by creating mock databases and websites. Just remember to log your activities so you can reference them on your resume and during interviews.

Apprenticeships and Mentors

Offer to assist an experienced IT professional, or learn business and soft skills by asking a business school alumnus to be your mentor.

Contests

Software companies often look for new talent by hosting annual contests. They're always looking for someone who can create a killer app or solve a difficult technical problem.

Student Organizations

Even if they're not tech-centered, these are good places to acquire leadership and teamwork skills. Serve as a club officer or dorm resident advisor, organize a campus event or mentor incoming freshmen.

Student Jobs

Being successful at any job, especially over time, demonstrates your work ethic and commitment. So don't give non-tech jobs short shrift. You can use them to build the track record that will help you succeed in the real world.

Tech Specialties

Business Intelligence

Overview

Businesses produce and capture incredible amounts of data. Sales figures pour in from one system, purchase orders from another and HR metrics roll in from a third. Out of these vast and disjointed streams, executives struggle to gain the insight they need not only to run their businesses day to day, but to develop their long-term strategies. By leveraging technology to turn raw data into usable information, Business Intelligence specialists help provide that insight.

Business intelligence and analytics — often referred to as BI — is about distilling and presenting relevant and timely data to end users for analysis and action. By creating systems that gather the appropriate data from disparate sources, BI provides decision makers with the tools to sift through mountains of facts and measurements to find actionable meaning.

Using historical data, executives can use BI systems to measure the results and health of their company, or plan for the future using predictive analytics. If you've ever had Amazon make a particularly prescient suggestion based on your historical buying habits, you've seen the power of the predictive analytics side of BI. In terms of jobs potential, well, businesses love this stuff. Seven out of 10 business leaders surveyed by Ziff Davis Enterprise in 2011 said they found it "very interesting."

After several rounds of buyouts and consolidations over the last few years, the biggest players in the BI market are Oracle, SAP, IBM and Microsoft. Many BI systems are implemented using software products from one of these vendors, or a mix from several of them. Each of the major software vendors, and smaller tier providers as well, have strong consulting and services divisions that employ hundreds of BI professionals.

Job Market Demand

Demand for Business Intelligence — and the people who understand it — is strong and is expected to stay that way. The research firm Gartner sees BI as being one of the fastest growing software markets around as more organizations begin relying on it. The **analysts, developers, and data warehouse professionals** who can execute both large and small implementations are well-positioned.

In addition to the steady maintenance of early BI adopters — many of them national restaurant chains and large retailers — there are two new active areas: the healthcare and energy industries, which are investing in large intelligence initiatives. While not completely recession-proof, organizations here have money to spend. Mobility has also opened up new opportunities. As workforces operate more from smartphones and tablets, collecting and processing mobile data in a meaningful way has become a huge challenge.

Roles and Career Paths

Jobs in BI fall into three categories: analysis, data warehouse and reporting/presentation.

In analysis, the **business analyst's** role is to walk between the worlds of business and technology. Analysts interview business domain experts to gather the requirements that need to be met. They then write functional specifications that the technical team uses to design and construct necessary solutions.

Data warehouse professionals are involved in building, populating, maintaining and managing data structures and databases. **Data architects** and **modelers** design both relational and multidimensional structures to accomplish the goals set out in the technical specification. **Developers** generally work in "Extract Transform and Load (ETL)." In other words,

they create systems to extract data from different sources, transform it into the desired format, and load it into the data warehouse.

People working in reporting and presentation create tools that allow decision makers to consume the data in a digestible format, one that puts it all in context. Developers work with **analysts** and domain experts to create dashboards, scorecards and reports from the data warehouse. Other professionals in this area include **report developers, reporting analysts** and **BI architects**.

Required Skills

For a career in Business Intelligence, you'll need:

- **A bachelor's degree** in computer science or equivalent experience.
- **Vendor-neutral certification** relating to business intelligence/analysis.
- **Proficiency in SQL** and relational database technology, as well as multidimensional database technology.
- **Knowledge** of data modeling and financial accounting procedures and standards.
- **An understanding** of data warehousing design principals, statistics, data analysis and reporting techniques. Also, an understanding of business intelligence dashboard solutions.
- **Experience** developing Business Objects, universes and reports.
- **Oral and written** communication skills, including presentation with programs such as PowerPoint and Visio.

Trade Groups and Resources

- **Academy of Competitive Intelligence:** A private enterprise offering seminars, distance learning and certifications in a variety of BI-related areas.
- **Competitive Intelligence Group:** A wide-ranging, somewhat eclectic group of discussions on "Tactical, Operational & Strategic Analysis of Markets, Competitors & Industries."
- **Data Warehousing Institute:** A professional organization calling itself "The Premier Source for Business Intelligence and Data Warehousing." It offers conferences, networking, education, certification and more.
- **IBM's Business Analytics Users' Group:** A global community for users of IBM Business Analytics solutions. Offers networking opportunities, shared ideas and professional enrichment. The groups include over 5,000 members from more than 65 local and regional users' groups.
- **Information Management:** Trade website with news, commentary and features for the information technology and business community. Offers in-depth case studies, original reporting, white paper resources and online education.

Training and Certifications

- **Certified Business Intelligence Professional:** A test-based credential from the Data Warehousing Institute. It combines core knowledge with application skills. Certification is offered in four key areas: Leadership and Management, Business Analytics, Data Analysis and Design, and Data Integration.
- **IBM Business Analytics Certification:** An industry standard benchmark for professionals working with IBM's Business Analytics technology.
- **IBM Cognos 8 BI Tech Specialist:** To earn this one, you'll have to participate "as an effective team member" on a Cognos product installation. You can find prerequisites and other details on the program's home page.

- **Oracle BI 10 Foundation Essentials:** Oracle says this exam ensures “that you have a strong foundation and expertise in Oracle Business Intelligence Suite and Enterprise Edition Plus (OBIEE).” The exam targets intermediate-level implementation professionals.
- **SAS Certified Platform Administrator 9:** For IT administrators responsible for installing, configuring, administering and maintaining the platform for SAS Business Analytics.

Terminology

Some key terms to know when working in Business Intelligence, from the basic to the complex:

Analytix: The application of technology, operational research, and statistics acquired through business intelligence practices to solve problems in business. It has evolved from the application of computers to the analysis of data taking place within an information system or software environment.

Balanced Scorecard: A performance management tool that summarizes an organization’s performance from multiple perspectives on a single page. The goal is to integrate performance measures into the basic management structure of the business. The four categories measured are financial performance, customer knowledge, internal business processes, and learning and growth.

Business Intelligence (BI): A set of business applications and technologies for gathering, storing, analyzing and converting data into information that powers future business strategies and decisions. It includes decision support systems, querying and reporting, online analytical processing (OLAP), statistical analysis, forecasting and data mining.

Business Performance Management (BPM): Processes that help businesses model various scenarios to discover efficient use of their business units, and financial, human, and material resources.

Dashboard: A user interface that organizes and presents information in an easy-to-read format and helps businesses match actions with strategy by tracking and analyzing key business metrics and goals. It will typically provide graphical depictions of current key performance indicators in order to enable faster response to changes in areas such as sales, customer relations and performance assessments.

Data Cleansing: The process of ensuring that a program operates on clean, correct and useful data. It includes manipulation of data using a variety of techniques.

Data Mining: The process of discovering previously unknown patterns within a data set, typically by testing the validity of different ways of describing the data.

Enterprise Resource Planning (ERP): Large applications used by enterprises to manage inventory and integrate business processes across multiple divisions and organizational boundaries.

Multidimensional Analysis: A technique for visualizing and analyzing business metrics across different points of view.

Slice and Dice: The practice of viewing data from any angle by using crosstabs and pivot tables.

Data Management & Strategy

Overview

In today's increasingly globalized economy, data has become a vital business asset. So the people responsible for the processes and systems used to organize, manage and control access to information have become critical resources.

For companies that use it correctly, data can be a competitive advantage. To be effective, it has to be accurate, consistent and transparent. Then, it has to be integrated into business applications and processes.

That means companies have come up with data management strategies that support their goals and objectives. With the exception of very large corporations, most organizations are struggling with the complexity surrounding data management and strategy.

The area takes on even more importance for companies dealing with mergers and acquisitions, evolving market tactics and dynamic regulatory requirements.

IT's role in all this is to maintain the enterprise data warehouse (EDW) architecture, which provides an ecosystem to serve new data management processes while accommodating future needs.

Job Market Demand

Database managers, data/information architects, modelers, analysts and administrators are becoming increasingly crucial to firms as they attempt to get a handle on this dynamic and evolving area. Develop an expertise in this sweet spot, and you could find yourself in high demand, particularly if you also develop a business sense that can help C-level executives align data with business goals.

In other words, Data Management and Strategy isn't only about the technology of handling data, it's about understanding how to put it to the best business use.

"There's a lot of data out there, and there are a lot of people who do programming," says Sanjay Bhandari, an independent consultant who works in data management. "They may know how to manipulate the data out of a system, but they are not always able to extract the business meaning of the data. That creates a gap."

Roles and Career Paths

One of the more strategic jobs involved in harnessing business data is that of the **data/information architect**. Typically, these folks are responsible for the overall design of the enterprise-wide data architecture. Mapped to the enterprise's overall IT system, their approach must balance the need for access against security and performance requirements.

In addition, architects must anticipate needs for enterprise-wide data modeling and database designs. Since they're the ones who define data and information architecture standards, policies and procedures, they may have the opportunity to take on deeper leadership roles.

A person targeting this type of position — which generally requires a bachelor's or master's degree in computer science, information systems or a related field — should understand most aspects of designing and constructing data architectures, operational data stores and data marts.

Those who want to attain a more mid-level position could consider a job as **database manager**, responsible for ensuring the design, maintenance and implementation of database management systems. You'll need the technical expertise to manage the design and development of your organization's database environment.

Data modelers serve in a more intermediate-level role, responsible for analyzing and developing complex but logical database designs, data models and relational data definitions.

Another intermediate-level role: **database analyst**. They're responsible not only for designing and developing database management systems, but also for analyzing requirements, application and processing architectures, data dictionaries and database plans. The job requires a bachelor's degree in computer science, information systems or a related field.

Database administrators manage and maintain all production and non-production databases and are responsible for standards and design of data storage, maintenance, access and security.

Increasing security concerns are giving rise to a new position called **database security analyst**. If you're interested in this, you'll have to be well-versed in Oracle, IBM and SQL Server databases, and also understand best practices and technology around database security. You'll need a high-level understanding of government regulations and how applications, operating systems, firewalls and networks interact, as well.

Trade Groups and Resources

- **Data Management Association:** An international, vendor-neutral association of technical and business professionals that works to enhance the practices surrounding information and data management.
- **Enterprise Data Management Council:** A trade association whose mission is to “address the issues and challenges associated with managing data content as a business and operational priority” in all aspects of the field.
- **Insurance Data Management Association:** An organization that helps professionals develop their skills and offers certifications, best practices, research and regulatory reporting.
- **Society for Clinical Data Management:** An organization that promotes excellence in data management. Based in Brussels, it has members in the U.S., India, Canada, China and the United Kingdom.

Training and Certifications

- **Certified Data Management Professional (CDMP):** The CDMP covers a combination of criteria including education, experience and professional level knowledge. Depending on performance, the credential is awarded at the “Practitioner” or “Mastery” level.
- **Certified Information Management Professional (CIMP):** The CIMP covers core information management principles or specific management disciplines, depending on the track you follow. Those include data quality, data governance, master data management, and data modeling and metadata management.
- **MySQL Certification:** A subset of Oracle certifications for consultants, developers and database administrators.
- **Oracle Certification Program:** Training on a variety of tools and practices using Oracle solutions.

Terminology

Some key terms to know when working in Data Management & Strategy, from the basic to the complex:

Access Management: The job of making sure that only approved users are able to create, read, update or delete data and ensuring that they are only using appropriate and controlled methods to do those things. Adhering to a strict access management plan can be important for regulatory and compliance reasons.

Audit: An independent examination to determine if data management is in compliance with a set of industry-standard or governmental requirements.

Compliance: A set of practices that dictate regulations, standards and contractual arrangements. Data managers may run into regulatory or contractual compliance and must also adhere to internal standards, policies and architectures, as well.

Data Architecture: A process of integrating sets of information into an overall scheme that operates optimally for the organization. It's one of the four Enterprise Architectures (with Application Architecture, Business Architecture and System Architecture).

Data Governance: The organizational bodies, rules, decision rights and accountabilities of people and information systems as they perform information-related processes.

Enterprise Architecture: The overall framework used to manage and align an organization's business processes, information technology (IT) software and hardware, local and wide area networks, people, operations and projects with the organization's overall strategy.

Information Architecture: The design and organization of data, unstructured information and documents. It can be considered synonymous with Data Architecture.

Master Data: The core entities of an enterprise that are used by multiple business process and IT systems. Examples include customers, employees, vendors, suppliers, locations, sales territories, offices, accounts, products, assets and document sets.

Metadata: Essentially "data about data." It provides descriptive information about a data element that outlines what it is, what it is used for and how it is used.

Risk Management: The practice of assessing, minimizing and preventing negative consequences posed by a potential threat. It can refer to any kind of physical, technical or legal risk, and is usually a heavily math-driven skill, based on probability analysis and statistics.

Workflow: The movement of data, documents or tasks through an organization's work processes, especially those processes that have been automated.

Games

Overview

Whether you play them on your smartphone, tablet, desktop or browser, this is the golden age of computer games. They're as slick as movies — and can cost as much to produce and market. They're worth big money, too. The top titles, like Call of Duty: Modern Warfare 2, earn hundreds of millions of dollars.

Today, the industry's most dramatic growth is in mobile, with scores of new titles being launched each day on iPhone, iPad and Android. (Mobile's culture of "anywhere, anytime" gaming is doubtless wreaking havoc on productivity across the world.) Twenty years ago, an episode of Star Trek: The Next Generation had aliens capture the Enterprise through an addictive computer game. Far-fetched? Now it seems prophetic.

Meantime, Web games have shown healthy growth, especially after developers began taking advantage of Adobe's Flash as a primary platform. Aided by hundreds of game aggregation sites such as Royalgames.com and Kongregate.com, they've grown to come in all shapes and sizes, and across most genres. Facebook, too, has been a major contributor to the growth of online games.

New Tools

As with most things tech, the tools used to build games are always changing. A relatively new tool on the scene is HTML5. First introduced in 2008, its growth was encouraged by the ban of Flash from Apple's iOS. Its Canvas and JavaScript functions allow developers to create pixel-perfect browser graphics and animation. That means they can create Web games that don't require — or support — Flash.

Then there's WebGL, a graphics driver that adds 3D OpenGL support to JavaScript, and so makes powerful 3D games available on your browser. Though just gaining steam, it should be fully mainstream within the next two years.

What You Need to Know

If you want to get into games, the technologies you'll need to know in the next five years are well established. You'll find details in the "Required Skills" area, but here's a summary:

For Mobile games, you should be familiar with Objective-C for iPhones/iPads, Java for Android phones and C# for Windows Phones.

For Web games, you'll need HTML5, CSS3 and JavaScript for the browser. For the server side, you can choose from Java, Python, JavaScript and PHP. Add SQL — generally, its MySQL — for the database work, and you'll be all set.

Required Skills

For game development, including Internet multi-player games, C or especially C++ is what you need. Games usually use Direct3D (on Windows) or OpenGL technology (on anything else), so you need to be familiar with these, as well.

You might also find it useful to learn Lua or Python for game scripting, which is used for in-game events — say triggering a message at a certain point in the game. With a built-in scripting language, you only have to change the game script source file, and no compilation is needed.

Other useful technologies — which may be a bit specialized — are sound and music programming, networking and how to write multi-threaded programs. Since big games need to be multiplayer, networking especially is a complex but highly useful skill.

For the Web development side, you'll need to know HTML5 and JavaScript. CSS helps as well but isn't mandatory, as it lets you fine-tune a game's appearance. For server-side work, you can use a variety of programming languages like Python, JavaScript, Java (not the same as JavaScript) and C++. C# is also starting to have an impact but Java, because it has been around for longer, still has the edge.

Using JavaScript lets you validate data and make the User Interface come to life. With Ajax technology, for example, you can update only parts of a page, rather than the whole thing at once. Libraries like JQuery make this simpler as well.

For both Web and game development you should familiarize yourself with at least one version control system (VCS). A VCS lets you keep multiple copies of the same file and make comparisons between different versions so you can see what changed. Even if your development team consists of just you, the usefulness of a VCS cannot be overstated. There are several open source products available (Git, Mercurial, Bazaar, Subversion) and a few commercial ones (Perforce).

Also, you should be aware of build systems. This is software that builds a complete application doing the compilation, linking, etc., and can be triggered manually or automatically. If the compilation or build fails, then an email is fired off to the developer who "broke the build," asking them to fix it.

Trade Groups and Resources

- **Casual Games Association:** An international trade association providing educational resources and community support for those who create games for the mass market.
- **Entertainment Software Association:** One of the most influential organizations in the industry, it's dedicated to serving the business and public affairs needs of companies that publish computer and video games on consoles, PCs and online.
- **Independent Game Developer Association:** An independent non-profit, it claims to be the largest membership organization for video game creators.
- **Independent Games Association:** A British trade group representing the UK's games industry. Members include independent developers, in-house publisher-owned developers, outsourcing companies, technology businesses and universities.
- **N.A. Simulation and Gaming Association:** A North American network of professionals working in the design, implementation and evaluation of games and simulations meant to improve learning results.

Training and Certifications

- **The Art Institutes:** A network of schools operating both online and at locations around the country, focused on the design and art aspects of game development.
- **California State University Certificate:** The California State University, East Bay, Certificate in Video Game Design and Development provides training for newcomers to the business. Requirements are simply a basic familiarity with computers and a high-school level math aptitude. Its curriculum covers programming languages, game mathematics, 3D graphics, real-time game engine architectures and artificial intelligence algorithms.
- **The Game Institute:** Provides professional training exclusively in video game production. Most offerings are approved for undergraduate college credit as well as continuing education units.
- **NAIT Game Development Certificate:** A certificate program that teaches students how to develop games using Microsoft XNA, and covers industry fundamentals including portable games, 2D-3D math and robotics.
- **Video Game Design and Development:** From the company ed2go, this is an online program for entry-level game professionals. The certificate program is offered in partnership with colleges, universities and other accredited education providers.

Terminology

Some key terms to know when working in games, from the basic to the complex:

Client Server: A program that serves the requests of other programs, known as “clients.” On the Web, a server provides pages to browsers. In multiplayer games, a server runs the games while clients display the actions and results and let players make their moves. Confusingly, a server can also be the computer that runs the server program.

Compiler: A program that converts an application’s source code to the language (machine code) that a computer’s processor understands. A further program called a Linker takes all a program’s compiled sources, links them together along with libraries needed to access the operating system, and outputs a single executable program.

Flash: Adobe Flash is currently the most popular technology for running action games in desktop Web browsers. Because most smartphones don’t support Flash, Adobe is reinventing it so developers have the option to output iOS projects for Apple devices and HTML5/JavaScript for websites.

HTML5: The name for the fifth generation of HTML (Hyper Text Markup Language), it also loosely refers to the JavaScript functions that work with HTML5, e.g., the Mobile Web. Most built-in smartphone browsers don’t support Flash, but HTML5 is increasingly supported. Some websites and games provide mobile friendly versions.

MMOG: Short for Massively Multiplayer Online Game. It’s often suffixed with other letters, such as RTS in MMORTS (Real Time Strategy), RPG as in MMORPG (Role Playing Game), or SG as in MMOSG (Sports Games).

Scripting Language: A name for a type of computer language that is not compiled but instead interpreted. JavaScript is one such language and can run on clients or as a server program. PHP is a very popular scripting language that only runs on Web servers.

FTP: Short for File Transfer Protocol, it’s a popular way to move files to computers across the Internet. Most Web and Web game developers use FTP to publish their games or websites. Software like Dreamweaver, which is used to design Web pages, usually includes an FTP client.

Web App: Short for Web Application, it means a website that provides a service. Multiplayer games that you play via a browser are examples of Web apps. A multiplayer game with its own client application (e.g. World of Warcraft) is not. Google Maps and Gmail are examples of complex Web apps.

Help Desk & Support

Overview

In many ways, the help desk and desktop support team are the face of IT. They're the front-line professionals who work with customers and help regular employees by making sure desktops, laptops, applications and networks are installed and working properly.

Starting as a help desk or support technician can be a good way to launch your career because you'll gain experience working with end users throughout the enterprise and learn what makes the business tick.

While the job requirements and opportunities vary by company, support roles generally fall into two categories.

Help desk **support technicians** typically diagnose and troubleshoot problems over the phone, so excellent communication and customer service skills are paramount. However, given the growth of outsourcing, some help desk workers have transitioned into analyst-type roles where they analyze trouble-ticket and call center trends and manage offshore resources.

Desktop support specialists usually deal with hardware and software issues on the company premises. They need to be detail-oriented and comfortable with a more hands-on approach. In general, they need more experience — three to five years — than their colleagues on the help desk.

Roles and Career Paths

Help Desk and Support technicians usually need an associate's or bachelor's degree to qualify for an entry-level role. They provide maintenance and support for basic products, peripherals and networks, but also configure and install software for desktops and laptops.

Technology analysts — who typically have three to five years of experience in support, problem solving or troubleshooting — are required to configure, install, monitor and maintain desktop hardware and software. They also support the mobile workforce. Sometimes, they're asked to solve problems that help desk technicians were unable to resolve. They may also train users while evaluating, maintaining and documenting desktop application packages.

Top performers often get the opportunity to move into a management role. **Desktop support managers** are responsible for ensuring technology users get the equipment and support they need, but also determine user needs and develop plans for support services.

It's possible to transition into **systems administration**, **data center operations** or **network management** in some companies, while in others technicians can move into **business analyst** roles, thanks to their problem-solving and communication skills and broad-based understanding of business operations.

Required Skills

For a career in Help Desk & Support, you'll need:

- **The ability to maintain composure** and work with others in stressful situations.
- **Customer service and communication skills**, including the ability to process user requests via telephone and e-mail and respond in a courteous, timely, and effective manner.
- **Detail orientation** to even the smallest detail.
- **The talent to understand** and carry out IT's plans for networking, security and systems administration.
- **The capacity to juggle and prioritize** multiple tasks or activities simultaneously.

- **The ability to diagnose problems**, document solutions and escalate issues appropriately, along with the ability to track and analyze trends in help desk requests and generate statistical reports.
- **Experience monitoring and testing** fixes to ensure problems have been adequately resolved.
- **Experience troubleshooting** using diagnostic techniques to identify problems, investigate causes and recommend solutions to correct hardware, software or system failures.

Trade Groups and Resources

- **Association of Support Professionals:** An international organization that works to advance technical support as a profession. Provides research reports, articles, links to independent experts and member contact lists.
- **Help Desk Institute:** An association of technical service and support professionals. It offers certifications, hosts industry conferences and events, produces publications and research, and connects solution providers with practitioners.
- **Technology Services Industry Association:** A professional association whose members include executives, managers and professionals representing the world's leading enterprise and consumer technology companies, as well as small and midsize businesses.
- **Technical Support Management:** A website that creates and maintains documents on technical support processes and practices for support organizations that operate in high technology product companies.

Training and Certifications

- **CompTIA A+:** A vendor-neutral certification that covers the basic knowledge and skills necessary for IT support. It includes areas such as installation, preventative maintenance, networking, security and troubleshooting.
- **ITIL Certifications:** A group of certifications covering basic understanding and performance of information systems. Its initial credential is the ITIL Service Management Foundation Certification.
- **Microsoft Certified Solutions Associate:** A certification for IT professionals and developers looking to get their first job in Microsoft technology.
- **Service Capability and Performance Standards:** A series of certifications that cover best practices in technical support centers, field service operations, internal corporate IT support, and call centers dealing with technical subjects.

Terminology

Some key terms to know when working in Help Desk & Support, from the basic to the complex:

Call Tracking: The process of collecting information about the calls that come into a help or service desk, perhaps by using software.

Dashboard: A collection of graphs, charts or statistics used to evaluate help desk responsiveness and performance.

Escalation: Elevating an unresolved request for support to a higher level team.

Service Level Agreement (SLA): Defines the timeline for responding to user requests and resolving problems.

Knowledge Base: A database containing solutions or answers to common user problems.

Root Cause Analysis: Determining the underlying cause of a problem.

IT & Data Center

Overview

Data centers, which often are housed in concrete-encased, temperature-controlled environments, are crucial components of most corporations. Comprised of servers, disk arrays, networking equipment and layers of applications, data centers keep an organization's day-to-day business operations moving along. In the cases of huge online companies such as Google and Facebook, the data center is the business.

It's an understatement, then, to say companies place a top priority on ensuring their data centers are performing at optimal levels while at the same time are protected from security breaches or natural disasters. The bottom line: Data centers must maintain high standards for assuring integrity and functionality of the disparate computer environments connected to them.

If you're thinking of building your career within data centers, realize you'll be working in an environment that's similar to the military. Data centers are like highly disciplined military operations, where individuals must work as part of a coordinated team. It's a place with well-honed processes, security standards and little room for error.

In recent years, the data center has become a more complex environment that requires a broader set of job skills. Network security, virtualization, cloud computing, unified communications, software as a service (SaaS) and information management are just some of the technologies data center specialists need to be familiar with.

In most organizations, data center operations involve multiple layers including storage, server and networking hardware, along with the software and applications that run on the equipment. Today, the centers are experiencing a lot of technology innovation, which makes it a dynamic time for graduates and young IT professionals who want to point their careers in this direction.

Roles and Career Paths

Virtualization: Server and storage virtualization have already transformed data center operations, particularly in large American corporations as they seek to consolidate systems and gain flexibility. These kinds of technologies are having a huge impact on how the data center is managed. This trend will continue as more data centers consolidate their networks into unified environments in which virtual machines play a major role. This means that people with expertise in virtualization will be valuable for some time to come.

Cloud Computing: Cloud expertise is also growing in demand as more companies incorporate cloud solutions into their strategies. Even if you're already familiar with associated technologies, it's extremely important that specialists stay current on where the cloud is in its development and how best to use it.

Unified Communications: Another career area in data center operations, involves the merger of voice, phone and email that is delivered via networks so that it provides users with a common experience.

Information/Content Management: This is the process of storing data, classifying it, making it more easily retrievable and archiving it. Even throughout the economic crisis, many content delivery networks continued to hire staff, though observers expect some consolidation because of the large number of venture-backed startups getting into the field.

Energy Expertise: Today, the biggest question many IT workers face is whether to become a generalist or a specialist. While there will always be specialized skills in data center operations, another movement's afoot that likely will put more emphasis on generalists: energy efficiency.

Traditionally, data center workers have operated separately from those in IT power facilities. That means those in the data center itself were involved in IT processing: **hardware managers, software and application developers, networking**

and **storage workers**. Then there were the **electricians, mechanics** and **facility engineers** and **power experts** who took care of the electrical and cooling systems.

As more demands are put on corporations to cut their energy consumption, these two sides of the house will have to communicate more effectively and achieve a better understanding of how the other side works. For example, the IT department now has to consider how much power an application might require to ensure that the facilities staff has the capacity to support it.

Required Skills

Among the skills most commonly sought for data center professionals:

- **Bachelor's degree** in computer science or related experience
- **Certification in networking** technologies
- **Experience with** server hardware, storage systems, and network connectivity, such as TCP/IP, DNS, data and voice network technologies
- **Understanding of virtualization** solutions
- **Proficiency with Microsoft** Windows and Office
- **Network troubleshooting** capabilities
- **Familiarity with** ERP, CRM, and Microsoft back-office infrastructure
- **Knowledge of HVAC and power requirements** for highly available data centers
- **Familiarity with SAN and NAS requirements** in production data centers

Trade Groups and Resources

- **AFCOM**: An organization of data center management professionals that offers discussions, education and a variety of resources.
- **Association of IT Professionals**: An international society that provides education and resources to support IT professionals.
- **Global IT Management Association**: Promotes the examination and dissemination of information related to IT management issues around the world, and examines topics related to academics, practitioners and the industry at large.
- **IT Industry Council**: An advocacy and policy group for technology companies. It works with businesses, policymakers and non-governmental organizations to encourage the use of IT around the world.
- **Open Data Center Alliance**: A consortium of executives from corporations that acts as a “unified voice for emerging data center and cloud computing requirements.” It encourages a faster transition to cloud computing.
- **TechAmerica**: An organization representing 1,000 companies from a range of sectors, including software, the Internet, cloud computing and IT services.

Training and Certifications

- **Cisco Data Center Certification Collection**: Offers five levels of general IT certifications, from entry level to architect, and nine tracks including routing and switching and network security.
- **CompTIA Programs**: A range of certifications and training programs that covers subjects ranging from Healthcare IT and IT support to project management and security.
- **Microsoft Certified Systems Engineer**: A program that allows professionals to demonstrate a broad cloud technology expertise and an understanding of the latest Microsoft technologies.

- **Microsoft Certified IT Professional:** Demonstrates a professional's knowledge of the skills necessary to perform a particular IT role, such as database administrator or enterprise messaging administrator.
- **VMware Certified Professional:** Requires completion of a VMware-authorized training program and hands-on experience with VMware technologies. Covers installation, deployment, scaling up and management.

Terminology

Some key terms to know when working in IT & Data Centers, from the basic to the complex:

Airside Economizer: A device consisting of fans, ducts, and controls that uses outside air to cool the data center when environmental conditions allow. Air is typically filtered, brought into existing distribution systems, and then sent back outside.

Branch Circuit Monitoring (BCM): A monitoring system used to record and monitor an individual electrical circuit.

Bypass Airflow: Conditioned air that doesn't reach computer equipment. Unintended bypass air can occur by escaping through cable cut-outs, holes under cabinets, misplaced perforated tiles, or holes in the computer room perimeter walls. It's wasteful and should be avoided.

Chiller: A unit consisting of a compressor, a condensing section, and an expansion section that is used to transfer heat away from critical computing systems.

Cooling Tower: A device that cools water by directly evaporating some of it. Water is pumped into the top of the cooling tower and allowed to run down over the fill, typically pads or strips, into a sump at the bottom of the cooling tower. Air is drawn in from the sides over the fill by fans in the top of the tower, evaporating some of the water, which cools the remaining water.

Carbon Usage Effectiveness (CUE): A metric defined by the Green Grid that measures data center sustainability in terms of data center-specific carbon emissions. It's calculated by dividing the total CO2 emissions caused by total data center energy by the energy consumption of the IT computing equipment.

Economization: Using the local environment around a data center to aid in cooling it by natural means rather than by using more energy.

Power Usage Effectiveness (PUE): A measure of data center efficiency calculated by dividing the total data center energy consumption by the energy consumption of the IT computing equipment. A typical score is 2.5, and a score of 1.6 is considered excellent. A perfect (and unattainable) score would be 1.0.

Recirculation: Air that exits IT equipment and then re-enters either the same equipment or another piece of equipment without being cooled. This is a bad thing and is typically caused by poor control of airflow because of missing blanking panels, gaps in rows or an insufficient air supply.

Water Usage Effectiveness (WUE): Another sustainability metric, this one measuring the water used onsite for data center operations including humidification and onsite evaporation for cooling or energy production. It's calculated by dividing annual water usage by the energy consumption of the equipment. The units of WUE are liters/kilowatt-hour (L/kWh).

Mobile Development

Overview

Mobile development is white-hot and tech college grads face a number of challenges and questions. What platforms should I be on? What tools and techniques should I know or be learning? Where should I focus my time when looking for a job? Should I be concentrating on the app store stuff or spending time romancing the big-picture, enterprise model?

Let's start with the basics of mobile platforms and tools.

Platforms

The dominant mobile platforms right now are Apple's iOS and Google's Android. Microsoft's Windows Phone and RIM's Blackberry OS round out the top four. Logic says that familiarity with one or several of these platforms gives you the best chance for new employment.

Deep knowledge of software and application development on traditional notebooks and servers will help you make the jump to the pocket-sized smartphones. Writing code, whether for mobile phone applications or Web pages, still requires some kind of networked notebook or desktop machine, because typing and debugging of code just isn't practical on a smartphone.

Developers who can make applications work seamlessly across multiple platforms will definitely be in high demand. Trends at the service provider or carrier level should figure into your mobile development professional plan too. The actions of the telecoms and networking companies can have profound effects on the industry.

Tools

Programming languages for mobile development aren't much different from the ones used in traditional PC and Web development. In fact, even if you aren't in purely mobile development, much of the programming might already be familiar to you.

Common languages include Javascript, HTML/HTML5/CSS/XML, C/C++, Java, Objective C, C#, PHP, Python and .NET. Common programming environments include Eclipse and Ruby On Rails.

Opportunities

As tablets and smartphones make their way into the enterprise, understanding how to deploy and manage them is becoming increasingly important — and so there's more demand for professionals who oversee those efforts.

Resource management (for both notebooks and smartphones) usually falls under the operations umbrella. New grads may want to get some experience in operations, in addition to programming.

Required Skills

Among the skills most commonly sought for mobile development professionals:

- **Coding:** Developers will need to know at least one mainstream programming language, such as Java or C# and have the ability to both read and write structures and processes that achieve a desired functionality or behavior.
- **Prototyping:** The ability to quickly understand a user's desired function or problem and then design and build a test solution (usually high level) demonstrating the proof of concept.
- **Networking Concepts:** Mobile applications depend greatly on the connectivity of the device to Internet and cloud-based services.

- **HTML5:** The latest version of HTML brings new automated and interactive process capabilities to Web page design.
- **Android:** Google's mobile device operating system is installed on a large number of different smartphones and tablets. It has many similarities with Linux and is quite popular with developers because of its relatively Open Source environment and huge community base. Android is licensed to a number of device manufacturers.
- **iOS:** Apple's mobile device operating system supports the iPhone, iPad and other Apple devices. It is not licensed for use on non-Apple devices.
- **Objective C and Java:** These two common programming languages are widely used to create applications on a variety of mobile devices.
- **Social Media:** Familiarity with social media, such as Facebook, LinkedIn and Twitter, helps developers stay connected with their user base and encourages direct feedback on projects.
- **Relational Databases:** Knowledge of this critical infrastructure technology is important because these systems supply important data (like inventory, pricing and status information) to many mobile applications and are integral to their operation.
- **Testing:** Knowledge and an appreciation of this skill is essential to being able to create useful, reliable, and quality mobile-oriented software.

Trade Groups and Resources

- **Apple iOS Developer Center:** Tools and guides to iOS technologies including programming information, interface guidelines and tools.
- **Google Android Developers Page:** Google's official home for Android developers, with development support, resources, code and more.
- **CDMA Development Group:** A consortium focused on further developing wireless telecommunications systems. It's made up of service providers, infrastructure manufacturers, device suppliers, test equipment vendors, application developers and content providers.
- **Mobile Portland:** A non-profit dedicated to educating, promoting and supporting the mobile technology community in the Portland, Oregon, area.
- **Open Handset Alliance:** Made up of technology and mobile companies that work to accelerate innovation in mobile development.
- **Symbian-Nokia:** Nokia's developers portal. Offers information and resources on app design, development, distribution and devices, as well as a professional community.
- **W3C Mobile Web:** A World Wide Web Consortium sub-group, it provides developer training programs, standards and technologies.

Training and Certifications

- **Advanced Certificate in Web and Mobile App Development:** A program of San Diego State University, it covers languages and frameworks, design of user interfaces and software systems, and associated topics including networking, hosting infrastructure and security.
- **BlackBerry Certified Application Developer:** A credential for professionals responsible for designing applications for BlackBerry solutions.
- **Certificate in Android Application Development:** From the University of Washington, this program covers stages of development as well as topics such as user interface design, application services, permissions and security, graphics and video, and application hosting.
- **Google Apps Certification Program:** For professionals who sell, distribute, administer and support Google apps, the program offers tracks in both sales and deployment.

Terminology

Some key terms to know when working in mobile development, from the basic to the complex:

Smartphone: A mobile device that combines a cell phone with Web access and interactive application capability over cell and Wi-Fi networks. It is characterized by color, interactive touch screen, dual-core processors, and advanced computing capability, while fitting into a pocket-sized package.

Tablet: A mobile device, partway between a smartphone and notebook, that provides Web access and interactive application capability, normally over Wi-Fi networks. Mobile broadband connectivity is a growing trend. They are characterized by color, interactive touch screens (in 7 and 10+ inch sizes), dual or quad-core processors, and advanced computing capability.

SDK: Software developer kit. A programming framework and developer environment used to create mobile applications. The SDK can be PC, Mac, or Web-based and consists of a programming language, various libraries, and development tools.

App: A program that runs on various mobile devices, that is usually downloaded from one of the marketplaces. Apps are also written by a growing freelance developer community and can be created using software developer kits (SDK) on personal computers.

Cross Platform: The ability for programs or operating systems to function on different hardware platforms. For example, Android might run on both a smartphone and a tablet, across many different manufacturers.

iOS: The operating system used on Apple products.

Android: An operating system used on the majority of non-Apple smartphones and tablets.

IDE: Integrated developer environment. A set of programming tools that are all activated from a common user interface.

Carrier: A company that provides trunk, broadband, and wireless-based services for a fee. The services can support private, governmental, commercial, and consumer connectivity.

Wireless: Networked connectivity through some type of radio transmission. Services are provided over cell, Wi-Fi, and specialty radio transceiver equipment and access points.

Networks

Overview

Networks form the communications backbone within an organization and out to the wider Internet. They're typically characterized in terms of spatial distances, as in local area networks (LANs), metropolitan area networks (MANs) and wide area networks (WANs).

The level of expertise IT network professionals need depends on the type of network they work with and its complexity level. When you connect multiple computers to a network, you've formed a LAN, but once the LAN is connected to a WAN, a network specialist will need a different skill set since WANs involve different routers and higher bandwidth performance levels.

Roles and Career Paths

Computer network technicians, also known as **computer network engineers** or **network specialists**, often help plan their employers' networks and then implement them. Most commonly, they administer existing computer networks and troubleshoot problems as they arise.

Network analysts and **network administrators** are more intermediate-level roles. A network analyst is responsible for designing, installing and troubleshooting networks to make sure their systems meet business objectives. They're involved with configuration and maintenance of the physical network components, perform capacity and resource planning, and assess network risks.

Administrators monitor, troubleshoot and maintain the LAN, WAN and wireless multiplexers, hubs and routers that move traffic through the network. However, their duties may also include installing new workstations or other devices, along with overseeing password protection and monitoring usage of shared resources.

Network architects are responsible for high-level network planning. They define the network designs for a company and work on multiple projects as a subject matter expert. Since network architects handle issues that are highly complex, they require in-depth knowledge across multiple technical areas and business segments.

Managers of network operations are mid-level managers who are typically responsible for operations and service levels for data and voice networking equipment and software. They also develop and implement standards, procedures and processes for the network operations group, and plan and manage the support of new technologies.

Directors of network operations, generally senior-level managers, have overall responsibility for department decisions and management. Reporting to the **chief information officer** or **IT chief operating officer**, they provide strategic direction, along with coaching and training of more junior IT staff. On a more granular level, directors are responsible for all work on network operations, including the integration of new technologies.

Trade Groups and Resources

- **Cisco IP Telecommunications User Group:** An organization for anyone using Cisco IP telecommunications products. It encourages members to share experiences, insights, concerns and solutions.
- **CompTIA:** A non-profit trade association representing IT professionals and companies. It focuses on education, certification, advocacy and philanthropy.
- **Network Professional Association:** A vendor-neutral organization for network computing professionals. It provides a code of ethics, professional development resources and information on best practices.

Training and Certifications

- **Cisco Certified Entry Networking Technician:** Covers networking fundamentals, WAN technologies, basic security and wireless concepts, routing and switching fundamentals, and configuring simple networks.
- **Cisco Certified Network Associate:** Covers basic mitigation of security threats, networking concepts and terminology, and measures performance-based skills. Also includes the use of these protocols such as IP, Serial Line Interface Protocol Frame Relay, VLANs and Ethernet.
- **Cisco Certified Network Professional:** Examines the ability to plan, implement, verify and troubleshoot local and wide-area enterprise networks, and work on advanced security, voice, wireless and video solutions.
- **CompTIA Network+:** Covers network technologies, installation and configuration, media and topologies, management and security.
- **CompTIA Server+:** Vendor-neutral credential covering hardware, software, storage, IT environment, disaster recovery and troubleshooting.
- **Microsoft Certified Systems Administrator:** For professionals and developers seeking their first job in Microsoft technology. It covers the core platform skills needed in an IT environment.

Project Management

Overview

Project Management is the process through which a project or task is managed from inception to completion. **Project managers** lead the team responsible for the effort. Whether they work for a client or a vendor, they're the ones who determine and implement the product's exact needs, based on their knowledge of the organization they're representing.

Typically, projects are constrained by some factor — usually time, cost, budget or scope. These items help define a project's deliverables, which represent a distinct set of work and provide beneficial changes and/or value-added items for a product. The ability to adapt to the internal procedures of the client, and to form close links with their representatives, is essential to ensuring that the key issues of cost, time, quality and — above all — client satisfaction are realized.

In the project management community, these items are also known as the “triple constraint” or “triangle.” The triple constraint represents the three major components of a project — scope, cost and time. One side of the triangle can't be changed without affecting the others. The overarching theme for all three is quality.

These constraints often compete: Increased scope typically means increased time and increased cost. A tight time constraint could mean increased costs and reduced scope, while a tight budget could mean increased time and reduced scope. The overall goal is to manage all three while protecting the overall quality of the project.

Project managers must not only meet the specifics of the triple constraint, but facilitate the entire development process to meet the expectations of those involved in or affected by the project activities. For example, other departments might be impacted by scheduling considerations.

A project manager's major task is the project plan. Typically, that includes a business case, project definition, scope definition, schedule, budget, and plans for change management, communications and resource management. The PM is responsible for creating and maintaining the plan throughout the lifecycle of the project.

A key to all projects is communication. PMs have to ensure that all stakeholders and resources are informed and aware of their status. They must also make sure all necessary roles are filled and have a voice in the project at appropriate times. The communication plan helps drive all the other areas of the project and ensures that there are fewer potential conflicts within both the team and project as a whole.

Required Skills

Among the skills most commonly sought for project managers:

- **Leadership Ability:** A leader must be able to motivate team members and ensure that they continue to move forward. They must inspire and enable teams to become a cohesive group, even though they may not have true authority over individuals.
- **Written and Verbal Communication:** These are key. Project Managers must be able to document and provide feedback in a positive and effective way.
- **Time Management:** You have to manage your time as well as your team's time. You'll provide schedules and goals for each team and its individuals as they move through the project. You also must know where the team is at, and be able to communicate its status at any given time to management and clients.
- **Budgeting/Financial Knowledge:** While you won't need to be an accountant and may not always own the budget, it is important to be able to manage a basic budget. The ability to track budgets is important as well as understanding such things as Actuals, Burn Downs, etc.

- **Presentation Abilities:** You're the leader of a team. You must be able to develop cohesive presentations and present to multiple levels of leadership within organizations.
- **Conflict Resolution:** The ability to negotiate difficult situations is priceless. Each situation is different, and the PM needs to have the skills to manage and facilitate challenges and resource issues without escalating on a frequent basis.
- **Negotiation**
- **Team Building:** You should have skills to help teams form and build good working relationships during the project.
- **Listening:** To lead without authority is a challenge. It's a silent expectation from companies because most don't provide you with the actual power to make full decisions.
- **Relationship Management:** Building relationships is very important. It is your job to understand the various resources on the team and determine how the team would work best together. This is a give and take process; no one answer will be correct.
- **Organization:** Project Managers must be able to organize most of what the team needs on a regular basis, in addition to what they need themselves.
- **Flexibility:** You need to be able to listen and react to enable the team to find ways to move through or past obstacles.
- **Ability to Maintain Composure:** The PM is the driving force in a project, but should always be the calming force to help continue its forward movement.

Trade Groups and Resources

- **Agile Alliance:** An international nonprofit that works to advance Agile project management development and practices. Offers events, resources and community groups.
- **American Alliance of Project Managers:** An international "board of standards" that offers graduate credentials including the Master Project Manager (MPM) and the Certified International Project Manager (CIPM).
- **Project Management Institute:** Probably the leading and most well-known group for project managers, PMI offers standards, certifications, resources and networking.
- **Scrum Alliance:** Offers educational resources, professional events and certifications related to the Scrum project management methodology.

Training and Certifications

- **Advanced Project Management Certification:** This Stanford University program requires three years of experience managing projects or programs, and a bachelor's degree or equivalent. It covers processes, organizational structures and tools.
- **Certified Associate in Project Management:** A PMI credential for entry-level project professionals. It's meant to demonstrate an understanding of fundamental knowledge, terminology and processes.
- **Certified Project Manager:** From the International Association of Product and Program Management, the CPM is a generalist credential designed to complement other certifications, such as PMI's Project Management Professional.
- **CompTIA Project+:** Covers pre-project set-up and initialization, planning, execution and delivery, change management, and communication. It has no prerequisites.
- **Master Project Manager:** From the American Alliance of Project Managers, this credential requires at least three years of experience and measures education, training, experience and industry knowledge.
- **Project Management Professional:** For experienced project managers, this highly respected credential from the Project Management Institute requires a bachelor's degree, at least three years of project management experience, 4,500 hours leading and directing projects and 35 hours of project management education. High school graduates are eligible if they have five years of experience, 7,500 hours leading projects and 35 hours of PM education.

Terminology

Some key terms to know when working in project management, from the basic to the complex:

Program Management: The process of providing execution certainty to meet the strategic business objectives of an owner.

Project Management: Management of projects around four basic elements: resources, time, money and scope.

Triple Constraint: PM Triangle — time, cost, and scope with overall quality. It is used to analyze or understand the difficulties that may arise from implementing and executing a project. All projects irrespective of their size will have many constraints.

SDLC: A system development life cycle is a product that describes a project from its inception to end. Primarily used in project management, there are many models developed to document the flow.

Project Charter: Includes fundamental information used to authorize and establish the basis for a project. It provides value and purpose for the project in terms of its value to the company.

Project Scope Document: A document that provides a definition of expected deliverables and outcomes for a project.

Scope Creep: When teams go outside of the expected and agreed-to scope of a project.

Resource Plan and Matrix: Listing of resources for the project and projected effort required from each one over the life of a project.

Functional Requirements: Defines the functionality that the system is to execute; for example, formatting some text or modulating a signal. They are sometimes known as capabilities.

Business Requirements: What must be delivered or accomplished to provide value.

Milestones: Points in time on the timeline that signify key time frames and deliverables for the project. This can be anything from the end of a phase or cycle to major meetings.

Deliverable: Documentation or expected results defined prior to the project start and to be completed within an expected time frame.

Project Plan: The overall plan for the project. This includes the timeline, milestones, deliverables, communication plan, risk management plan and change management.

Change Management: A planned and systematic approach for managing change on all levels of a project.

Budget Management: Management of all areas of the budget — from deliverables to resources and timeline. There are various ways to analyze and manage the budget, from simple tracking of spending to actual vs. planned spending.

Resource Management: Part of the project plan. The team identifies resources needed on the project as well as the level of effort and budget associated with each individual. It enables the project manager to evaluate the status of the project and to project upcoming needs on the project over time.

Traceability: Suggests an effort to allow tracking of each requirement from inception to production.

Security

Overview

Thanks to the Internet, most of our security perimeters are gone. Cloud apps are the current rage, but some of them have major security loopholes. You can't spend enough time tweaking your firewalls.

No matter how hard you try to lock them down, endpoints will continue to compromise your network. And your best people are also your biggest security threat, because they can inadvertently — or deliberately — leave open doors to your corporate data.

As a result, IT security professionals aren't only in demand, they're to see more opportunities as the years go on.

Here's a few trends to consider:

- **What Security Policies?** Last year, Cisco reported that Gen Y — to the tune of 70 percent — is likely to ignore their IT department's security policies.
- **Back to Basics with Web Apps.** Security vendor Cenzic lists a number of vulnerabilities with popular cloud-based apps. The issues aren't new exploits, but things that have been around for dozens of years, like SQL Injection or Cross Site Scripting.
- **Better Endpoint Protection May Not be Enough.** In the past year, many anti-virus vendors have begun offering features like streaming updates, integrated browser protection and better ways to thwart zero-day exploits. But all this may still not be enough, since there are plenty of insecure endpoints roaming the corporate halls.
- **Bringing Your Own Device is a Security Sinkhole.** More and more companies are allowing anyone to bring any device and connect it to their corporate network. The security concerns and challenges here are obvious.
- **IT Isn't Needed to Deliver Desktop Apps Anymore.** We don't need to buy any software or install it on our own desktops: Everything is available in the cloud at a moment's notice. Software repositories such as GitHub and open source projects like Apache have blossomed into places that corporate developers use daily.

Required Skills

Among the skills most commonly sought for IT security professionals:

- Attention to detail
- Ability to understand law and regulatory policies
- Comfortable working with multiple departments

Trade Groups and Resources

- **Information Systems Security Association:** An international organization that promotes practices to improve confidentiality, integrity and the availability of resources. It offers educational forums, publications and networking opportunities.
- **McAfee Labs:** Created by one of the leading security software companies, McAfee Labs provides information on global threats and vulnerabilities. An important tool for staying on top of tactical security data.
- **OWASP:** The Open Web Application Security Project is an international, vendor-neutral non-profit that focuses on improving software security. It offers a range of free resources.

- **SANS Institute:** The umbrella organization for security professionals, its members include auditors, network administrators and chief information security officers. It offers resources, events, training and certifications.
- **Symantec SecurityFocus:** Produced by security solutions provider Symantec, it provides original news and detailed technical papers for technology security professionals, as well as up-to-date information on new and current threats and vulnerabilities.

Training and Certifications

- **Certified Information Systems Security Professional:** Demonstrates competence on critical security topics such as cloud computing, mobile security, application development security and risk management.
- **CheckPoint Certified Security Expert:** Mainly for CheckPoint firewalls, the CCSE is a basic three-day class offered frequently. It teaches techniques to maximize security systems including troubleshooting Firewall-1, upgrading, VPN implementations and user management.
- **Cisco Certified Network Associate Security:** This certification covers the associate-level knowledge and skills required to secure Cisco networks. It includes topics such as developing a security infrastructure, recognizing threats and vulnerabilities and mitigating them.
- **CyberSecurity Forensic Analyst:** From EC-Council, this program offers dozens of courses including certified ethical hacker, licensed penetration tester and certified secure programmer.
- **SANS Information Security Training:** A set of courses and certifications covering security basics, enterprise defense, implementation and auditing, forensics, incident handling and other topics.

Software Engineering

Overview

Software engineering spans a range of efforts from desktop applications to Web page design to extremely exotic operating system code. As you go into the workforce, you'll have questions about choosing the right path: What platforms should I be on? What tools and techniques should I know?

Let's start with the basics of software platforms and tools.

Platforms

The dominant platforms today are Microsoft Windows, iOS on Apple products, Linux/Unix, Web-based (like Google cloud-based applications) and mobile. As a developer, you might work on a desktop application, some utility program, an operating system, websites and a bewildering assortment of other projects. There are even opportunities to work on things as specialized as firmware that direct appliances like a dishwasher or refrigerator.

In terms of hardware, Intel, AMD, Via Technologies and Nvidia dominate the PC chip market. Server hardware and specialty systems come from a variety of manufacturers. Code and systems need to be written for them, as well.

Tools

When designing Web applications you might need to learn Javascript, Python, PHP or .NET. Embedded software might require you to learn embedded C or Processing. And, there are a host of related "systems" like SharePoint and SQL that aren't really languages, but rather customizable environments that you use to collect, slice and dice data.

Logic says that familiarity with several of these platforms gives you the best chance for new employment. Logic is right.

Opportunities

It's very important to understand your craft at the technical level. Great programmers have a serious passion for writing code. They enjoy the challenge of solving problems and accomplishing things. Find a way to document all your accomplishments in an organized and visible way. Seek out and participate in great projects.

Two ways to get your foot in the door are to do volunteer work and internships. Open Source projects are always looking for skilled engineers and programmers to roll out the latest revisions. Get on one of those projects, learn the ropes and grow your reputation as somebody who gets things done.

Look around for internship opportunities, ideally, before you graduate. A lot of times you can transition right into the company as a full-timer.

That's a lot to know. But the payoff can be worth it.

Required Skills

Among the skills most commonly sought for security Software Engineers:

- **Reading Code:** The ability to understand an existing piece of code so analysis, fixes, and enhancements to the functionality can be applied. Common mainstream programming languages might include C, Ruby, .NET, assembler or PHP.
- **Writing Code:** The ability to create structures and working programs that perform useful functions generally characterized with inputs, outputs and a defined process.
- **Design:** The ability to formulate the requirements of a program and create an architecture and code that will achieve the desired function.

- **Prototyping:** The ability to quickly understand a user's desired function or problem and then design and build a test solution (usually high level) demonstrating the proof of concept.
- **Debugging:** The act of analyzing and locating problems (bugs) in software code, in order to correct errors and allow the program to function as specified or required.
- **Revision Control:** An understanding of how a code maintenance system is set up and administered is important to generating efficient and usable code, on deadline, in production environments.
- **Compliance:** This skill deals with how a piece of software or system fits into or complies with government regulations. Knowledge and awareness of the regulations is important, as well as documentation and testing data to verify that the software meets the reporting standards.
- **Quality Assurance:** Knowledge of how to test and verify program functions ensures that the user will have a positive experience and the software will perform as advertised. Although perhaps not as glamorous as coding, the function is a key part of application acceptance and success.
- **Project Management:** Organizing and ensuring that a project stays on track, overcomes challenges, and leads to successful deployment is a highly sought-after skill in the modern software development industry. Much of the work is documentation and reporting, along with working across departmental boundaries to get the job done.
- **Integrated Development Environments (IDEs):** Developers are expected to understand and use these tools, because they streamline the build cycle and reduce errors by automating repetitive programming tasks.

Trade Groups and Resources

- **Association of Software Professionals:** Trade association for software developers working on desktop and laptop programs, software as a service (SaaS) applications, cloud computing and mobile apps.
- **Business Application Software Developer Association:** UK-based nonprofit that facilitates the sharing of knowledge among professionals and addresses strategic issues and evolving legal, political and technical influences affecting the business software industry.
- **Institute of Electrical and Electronic Engineers:** A highly respected professional association focused on technological innovation and excellence. It produces publications, conferences, technology standards and professional and educational activities.
- **Software Information Industry Association:** Trade association for the software and digital content industries. It provides global services in government relations, business development, corporate education and intellectual property protection.
- **Technology Services Industry Association:** Professional association whose members include executives, managers and professionals representing the enterprise and consumer technology companies, as well as small and midsize businesses.

Training and Certifications

- **Apple Certifications:** Awards certificates for OS X, Mac integration and Mac technician. There's a separate track for creative professionals that covers skills in Apple pro applications.
- **Cisco Information Technology Certifications:** Five levels of general IT certifications covering entry-level, associate, professional, expert and architect in nine different tracks.
- **Global Information Assurance Certifications:** More than 20 specialized security certifications for security professionals and developers, matched to specific job duties.
- **Linux Professional Institute Certifications:** A distribution-neutral series of certifications that covers knowledge and skills for any standard Linux system.
- **Microsoft Certifications:** Series of credentials covering most Microsoft products and technologies at all skill levels.
- **Oracle Certification Program:** A comprehensive package of training for tools and practices using Oracle solutions.

Terminology

Some key terms to know when working in software engineering, from the basic to the complex:

SDLC: Short for software development life cycle, this term describes the end-to-end creation of a program or system and includes brainstorming, defining functionality, prototyping, coding, testing, approval, revision methodology, release, user support, business integration, optimization, documentation and sun-setting.

API (Application Program Interface): The high-level standardized methodology to allow programs to communicate with each other and allow transfer of commands and data.

IDE (Integrated Development Environment): This term describes a group of programs used by developers to create purpose-built software, using standardized techniques, tools and methodologies. The goal of an IDE is to streamline the programming process, making the coding easier and less prone to errors, thereby raising the programmer's proficiency.

Programming Language: These are computer process instructions written in a human readable form. The coding is normally converted from the human readable form to low-level instructions that a machine can execute natively. Common examples of programming languages include C, Pascal, Lisp, Ruby, PHP and Basic.

Server: A machine or process used to provide files, applications and data to other machines over a network. Common servers (in a hardware sense) are blade- and rack-mounted machines. Apache, FTP and MySQL are mainstream software programs designed to deliver Web pages, general files and database information to client machines and applications.

Client: A machine or process that queries and accepts files delivered from a server.

Web 2.0: The second generation of Web-based applications that typically use a database-oriented client/server infrastructure and a browser-based user interface, and which are deployed to enterprise (and larger) audiences across multiple networks and systems.