

# NYC Tech Talent Pipeline

## NYC Industry Insights:

Key Skills and Competencies Needed for  
In-Demand, Entry-Level Tech Jobs  
in New York City

Fall 2016

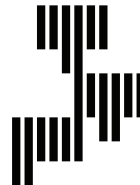


**NYC**<sup>TM</sup>

Small Business  
Services

---

Bill de Blasio  
Mayor



NYC  
Tech Talent  
Pipeline

NYC has the systems and people to deliver on an unprecedented scale.

31,000  
BUSINESSES

1.1M  
IN NYC SCHOOLS

300,000  
TECH JOBS

\$500M  
PUBLIC WORKFORCE  
SYSTEM

10+  
INDUSTRIES

8.4M  
NEW YORKERS

125+  
ACADEMIC  
INSTITUTIONS



## OUR ADVISORY BOARD

The NYC Tech Talent Pipeline Advisory Board is comprised of 28 CEOs, CTOs, CIOs, and senior executives representing the city's top tech employers and a collective workforce of 50,000 New Yorkers.

**Allen Blue**  
Co-Founder, LinkedIn

**Yancey Strickler**  
CEO, Kickstarter

**Rochelle King**  
VP of Data, Insights,  
and Design, Spotify

**Judy Spitz**  
CIO, Verizon

**Charles Phillips**  
CEO, Infor

**David Kline**  
Chief Technology  
Officer, Viacom

**Fred Wilson**  
Managing Partner,  
Union Square Ventures

**William Floyd**  
Head of External  
Affairs, Google NY

**Antoine Veliz**  
Chief Experience  
Officer, Interbrand

**Kevin Ryan**  
Founder, MongoDB,  
Business Insider, Zola,  
Gilt Groupe

**Marissa Shorenstein,**  
President, AT&T  
New York

**David Tisch**  
Co-founder, Techstars;  
Head of Startup  
Studio, Cornell Tech;  
Managing Partner,  
BoxGroup

**Don Duet**  
Co-Head of  
Technology,  
Goldman Sachs

**Oliver Kharraz**  
Co-Founder &  
President, ZocDoc

**Jesse Hertzberg**  
CEO, Livestream

**Chris Hughes**  
Co-Founder, Facebook

**Jeff Reynar**  
Engineering Director,  
Facebook New York

**David Fullerton**  
VP of Engineering,  
Stack Exchange

**Ali Marano**  
Head of Technology  
and Social Good, JP  
Morgan

**Serkan Piantino**  
Former Head of  
Facebook New York

**Eliot Horowitz**  
Co-Founder and CTO,  
MongoDB

**Brandon Atkinson**  
Chief People Officer,  
AppNexus

**Chad Dickerson**  
CEO, Etsy

**Jon Williams**  
Co-founder, CTO Club

**John Paul Farmer**  
Director of Tech &  
Civic Innovation,  
Microsoft NY

**Jocelyn Leavitt**  
Co-Founder and CEO,  
Hopscotch

**Paul Cheesbrough**  
CTO, Newscorp

**Meghan Lapidés**  
Head of Human  
Resources, Foursquare



---

## TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
SECTION I: A GROWING NEED FOR TECH TALENT	3
THE CURRENT CHALLENGE	3
A NEW APPROACH: THE NYC TECH TALENT PIPELINE	4
BRIDGING THE GAP	5
SECTION II: SKILLS NEEDED FOR SECURING AND SUCCEEDING IN TECH ROLES	6
FOUNDATIONAL SKILLS AND KNOWLEDGE	6
TECHNICAL SKILLS: ROLE-SPECIFIC	10
TECHNICAL SKILLS: APPLIED	15
EXPERIENCE AND EXPOSURE	19
PROFESSIONAL SKILLS AND INTERESTS	21
NEXT STEPS FOR DELIVERING QUALITY TALENT	25
ACKNOWLEDGEMENTS	26

---

## EXECUTIVE SUMMARY

New York City is well positioned to deliver technical talent at a significant scale. The NYC tech ecosystem is thriving, supporting over 291,000 jobs and \$30 billion in wages annually. Across the city, 125 higher education institutions, 1.1 million public school students, and a \$500 million workforce system are poised to equip residents of the five boroughs with the skills they need to succeed in 21st century jobs. Yet, despite high employer demand and infrastructure to meet it, businesses are struggling to fill open roles and tech jobs remain out of reach for New Yorkers.

Recognizing an opportunity and responsibility to ensure that the continued growth of the city's tech ecosystem is powered by local, homegrown talent, in May 2014, Mayor Bill de Blasio launched the **NYC Tech Talent Pipeline (TTP)**. One of six Industry Partnerships supported by NYC's Department of Small Businesses Services, TTP works with a diverse and powerful group of companies, education and training providers, policy makers, community organizations, and other key stakeholders to **deliver quality jobs for New Yorkers and quality talent for New York's businesses.**

Since launching, the NYC Tech Talent Pipeline has spent hundreds of hours together with its network of 150+ industry partners defining the set of skills that are needed to secure and succeed in "in-demand" tech roles. Through one-on-one conversations, programmatic investments, curriculum review with academic institutions, and other engagements, TTP companies have shared that what they look for above all in tech candidates is someone who can demonstrate that they are "smart and gets things done."

*"We look for evidence, not claims," says a hiring manager at TTP partner company. "A CS degree or certificate of completion is a claim. Show us you've built something accessible and be able to talk about it well."*

However, feedback from these tech employers also suggests that few NYC companies consistently turn to local sources to find this talent, opting instead to recruit from known high-return academic institutions in the northeast and California. Responding to this deficit, TTP has worked together with industry partners day-in and day-out to more precisely define the skills and competencies required for "in-demand" tech roles in New York City. This effort includes unpacking what skills, aptitudes, and competencies are truly represented by a bachelor's degree.

Summarized in this report are the five key competencies required for entry level in-demand tech roles as identified by NYC tech business leaders. In particular, this summary

---

focuses on the high need occupations of web development / software engineering with a focus on web applications. While every company may place different value on each of these themes when considering candidates for open tech roles, tech employers across the NYC “tech ecosystem”<sup>i</sup> generally cite the following as critical attributes of well-rounded, competitive candidates:

1. **Foundational skills and knowledge**, particularly critical thinking and problem solving – two skills that are essential in a profession that requires breaking down complex technical problems into their component parts;
2. **Technical skills**, which vary by company and role but include languages, frameworks, and the theoretical underpinnings that inform technical decisions;
3. **Applied skills**, including resources, tools, and demonstration of technical skills in “real world” settings;
4. **Experience and exposure**, ranging from more traditional experience gained through on-the-job opportunities to side projects and hackathon participation; and
5. **Professional skills and interests**, from the all-important passion for tech to the many professional skills that can be learned, including the ability to work effectively as part of a team and navigate the job application process.

The result is a clearer picture of what it takes to secure and succeed in 21st century tech jobs. This information provides the critical foundation for transforming the way NYC’s tech employers find great talent, equipped with a more accurate filter than a limited pool of degrees. It also forms the basis for partnering with education and training providers to ensure that New Yorkers of all backgrounds are prepared to pursue the quality tech jobs employers are eager to fill.

---

## SECTION I: A GROWING NEED FOR TECH TALENT

### THE CURRENT CHALLENGE

New York City is well positioned to deliver technical talent at a significant scale. In addition to the 8.4 million residents who live within the five boroughs, the City is also home to 100+ higher education institutions, a \$500 million public workforce system, and a public school network that serves over 1.1 million students. Altogether, these resources form a foundation upon which a strong, continuous, and accessible pipeline of technical talent can be built – one that reflects the creativity, diversity, and passion of all New Yorkers.

And demand for such talent is strong. The tech industry is among the fastest growing and highest paying sectors in NYC, representing 291,000 jobs and \$30 billion in wages annually.<sup>ii</sup> Between 2003 and 2013, employment in the NYC tech ecosystem grew by 18% – a rate that outpaced both citywide and total U.S. employment.<sup>iii</sup> Across the city, over 31,000 companies employ tech talent and are hungry for skilled candidates who can help their businesses start, grow and thrive.<sup>iv</sup>

Yet despite business demand for talent and an infrastructure well-positioned to deliver it, tech jobs remain out of reach for New Yorkers. Many tech employers report a shortage in the number of qualified homegrown candidates for in-demand roles. According to an analysis of the city’s tech skill supply and demand across LinkedIn’s 3.1 million members, 7% of NYC workers have some tech skills, but just 2% possess the in-demand skills that employers seek.<sup>v</sup>

Part of this gap can be attributed to the rapid rate of job growth in fields like software engineering, where employment is expected to expand by 30.4% in New York City between 2012 and 2022.<sup>vi</sup> However, employer feedback suggests that numbers alone are not to blame for a dearth of employable talent. Companies report that a significant portion of candidates emerging from NYC-based education and training institutions just aren’t fully prepared with the full range of skills needed to effectively compete with candidates from other corners of the U.S. or across the world.

---

## A NEW APPROACH: THE NYC TECH TALENT PIPELINE

Since Mayor Bill de Blasio launched the NYC Tech Talent Pipeline in May 2014 as the City's tech Industry Partnership, TTP has concentrated efforts on building a network of 150+ companies committed to working with the City to define needs, develop training and education solutions to meet these needs, and elucidate barriers to scale and sustainability. As an integral part of this work, TTP collects regular feedback from employers on the skills and aptitudes required for securing and succeeding in in-demand roles across the city's tech employers.

Historically, some employers – as well as public and private funding streams – have placed an emphasis on tech degrees and certificates as indicators of an individual's skills and employability. While these credentials can be useful, if the training and education providers granting degrees or certificates are not aligned with employer need, then these signals become imperfect indicators of what a candidate can actually deliver. The majority of TTP industry partners, when asked to describe their ideal candidate, state an overwhelming preference for someone who is “smart and gets things done,” regardless of their formal educational background.

In order to expand the delivery of quality jobs for New Yorkers and quality talent for the city's businesses, TTP has engaged employers in more precisely defining the core competencies, skills, and tools that today's in-demand tech workforce requires. In many cases, this includes working with industry partners to define what skills bachelor's degrees in computer science, for instance, may signify, and to articulate other means by which individuals can acquire and demonstrate these skills and abilities. The feedback below is the direct result of many such conversations, and reinforces the importance of defining employability beyond certificates, degree attainment, or even knowledge of specific programming languages.

The information below was collected through a series of initiatives developed together with TTP industry partners. Through direct investment in program development, TTP works together with employer partners to develop job descriptions, screening tools, curriculum, and applied projects to demonstrate candidates' skills. In order to provide real-time feedback on the relevance of program participants' skills, TTP further engages industry partners in reviewing candidates before admission to programs, while hosting interns on site, and after candidates emerge from training.

Thanks to these direct investments, TTP-facilitated industry review of curriculum at 15 NYC colleges, candidate feedback provided by hiring managers, and one-on-one

---

meetings with CTOs, CEOs, and CIOs, TTP has amassed a collection of industry insight into what skills are needed to secure and succeed in tech roles.

## BRIDGING THE GAP

As a result of its work, the NYC Tech Talent Pipeline has developed a clearer picture of why and where the city's current resources are failing to prepare New Yorkers to meet the needs of employers. With greater understanding of these gaps comes a tremendous opportunity for the city's education and training providers, community groups, and policy makers to improve alignment of tech training and education pathways with the needs of NYC's growing tech ecosystem. With it also comes an opportunity for employers to more accurately find and surface the tremendous talent that can meet these needs regardless of educational pathway.

Regardless of how this tool is used and by whom, it's important to note the following considerations when reviewing this feedback:

- **Focus on requirements for in-demand, entry-level tech jobs:** This summary describes frequently cited competencies and aptitudes that employers look for in candidates hoping to secure their first tech jobs.
- **General applicability; role-specific perspective:** In order to illustrate concrete examples within each of these categories, this document shares feedback on technical and applied skills that are specifically relevant to full-stack web developers and software engineers with a focus on web applications, two overlapping occupations in high demand across the NYC talent market today. Though the technical and applied skills described below are not applicable to all in-demand positions across the tech labor market, the broader foundational capabilities, professional skills, and insights related to experience/exposure are relevant across many additional rapidly evolving tech occupations.
- **Common themes; varying specific requirements:** While the information presented below represents key themes that emerged across feedback from many employers, each company places different emphasis on particular skills, tools, and other aptitudes. The resulting profile presented below is that of an ideal entry level candidate, and some companies may not require that an individual possess all of these qualities in equal measure.

---

## SECTION II: SKILLS NEEDED FOR SECURING & SUCCEEDING IN TECH ROLES

Five key competencies emerge from the feedback provided by TTP industry partners – NYC companies that range from startups to fortune 500 companies and represent a variety of sectors from media to finance. While every company may place different value on each of these themes when considering candidates for open tech roles, tech employers across the NYC tech ecosystem generally cite the following core competencies as critical attributes of well-rounded, competitive candidates.

### 1. FOUNDATIONAL SKILLS AND KNOWLEDGE

*“...what developers do is get really good at figuring out how to solve a problem. They don’t know everything, but they want to find out.”*  
– Engineering Lead, NYC Tech Company

Amongst the most common refrain from employers is that, in order to be successful, tech professionals must demonstrate a strong base of foundational skills and knowledge. In particular, industry partners emphasize that tech professionals must be able to identify and navigate problems, surface creative solutions, and persist in the face of difficulties. Among the concrete foundational skills needed to successfully meet this demand are:

- **Critical thinking and problem-solving:** Regardless of their role, tech professionals must demonstrate excellent critical thinking and problem-solving skills. Fundamentally speaking, many tech roles require an ability to give instructions to a computer in an environment where there usually isn’t one “right” way to do something. As a result, tech professionals of all types must be able to **identify a problem or challenge, conceptualize a way (or multiple ways) they could approach it, consider potential effects of additional factors, and test different solutions until they find one that works.** Specifically, she/he must be able to:
  - **Define potential problems:** Often, tech professionals must accurately define the problem before they can begin to break it down or identify possible solutions. Recognizing this emerging need within their own workplaces, some tech employers have begun testing the ability of candidates to define potential problems before defining possible solutions.

- **Ask effective clarifying questions** to ensure an understanding of the problem and to help get to the root of the problem. Candidates cannot be afraid to ask questions; this is critical to finding an answer that adequately meets the needs of any product’s end user.
- **Break down complex problems** into their component parts, form hypotheses to test them, consider the effects of additional factors, and eliminate potential problems one by one.
- **Employ creative thinking:** Employers note that successful tech professionals must be able to step back from a problem to think creatively about potential alternate solutions.
- **Know how to find a plausible answer independently:** Tech professionals emphasize that no one is expected to know everything, but everyone must be able to sort through and locate helpful resources to build their knowledge. This includes an ability to:
  - \* **Identify essential requirements** that define the answer they need to solve, based on users, stakeholders, and constraints,
  - \* **Single out** missing information and determine the best way to find it, whether through existing resources, an online search, available libraries, etc.,
  - \* **Sort** through varied information to determine what’s useful and reliable, and
  - \* **Use** those resources to learn something new, figure out a problem, and/or locate additional helpful resources.
- **Deal effectively with dead ends, frustration:** As part of this process, candidates must be able to demonstrate their ability to overcome frustration effectively. When one approach doesn’t work, rather than becoming despondent or giving up, strong candidates are able to take a step back, regroup, and try a different way.
- **Fundamental technical understanding – basic:** Candidates also should have a basic understanding of how the Internet, computing, and web-based technologies function. Whether it be an IT Engineer, a Web Developer, or a

---

## Skills in Action: Dealing Effectively with Dead Ends

A team of engineers and recruiters were hosting an all-day interview event for junior engineering candidates at their firm. Throughout the day, they had the chance to interview roughly two dozen candidates hailing from both undergraduate programs and accelerated tech boot camps. As part of the interview process, existing engineers presented candidates with coding questions and asked them to talk through their proposed solutions. The questions, by design, were slightly more difficult than emerging talent looking to secure their first job as an engineer would be expected to know the answer to.

When asked after the day was over why they chose to hire particular candidates, the company's engineers reported – among other data points – that several candidates failed because they could not persevere when faced with an unexpected and daunting challenge. “They just gave up,” said one engineer. Those who were reviewed more positively were able to admit when they didn't know something, but rather than giving up, they talked through all potential solutions and each one's limitations. “One woman even asked me how I would go about solving it. Even though she didn't know the answer, she showed that she wanted to learn and was willing to take feedback, whereas others just threw their hands up. That's great,” the engineer said.

Data Analyst, everyone who strives to have a career in technology should have a solid understanding of these basics in order to understand how the work they're doing may be influenced by and/or influence these underlying factors. In particular, candidates should understand how the Internet works, including:

- o Primary: HTTP, DNS, SSL, JSON
- o Secondary: TCP/IP, Load Balancers
- **Strong desire and ability to learn:** One of the most important characteristics of a strong candidate is the desire and ability to find and learn new material, as tech fields evolve constantly and developers must continually learn and apply new information to their work. Tech professionals must be able to conduct effective research (find and sort through various resources to find useful, reliable information) and teach themselves new material in an ever-evolving field. This includes learning and being able to apply new languages to solve business problems.

- 
- **Grit, perseverance, and tenacity:** Many employers say that they look for some combination of grit<sup>vii</sup> (perseverance and passion for long-term goals) and tenacity in their candidates. Generally speaking, since in-demand tech jobs require patience, determination, and an ability to work through complex problems, employers look for individuals who remain intent on resolving a challenge even when the going gets tough.
  - **Curiosity:** Part of being a good problem-solver is an inherent curiosity that drives people to want to uncover and overcome new frontiers in the first place. As a result, many employers look for an indication of curiosity in their employees, and may ask different types of questions to gauge this during an interview, from review of tech-related personal/side projects and non-tech extracurriculars to inquiries about a candidate's reading list.
  - **Literacy, including:**
    - o **General reading comprehension:** Developers are often expected to uncover and apply feasible solutions based on their ability to understand and learn from the work of others.
    - o **Understanding dense technical material:** Many technical professions require an ability to read dense technical material. It's important for individuals to be able to read documentation with attention and rigor and accurately pick out and apply important information.

---

## 2. TECHNICAL SKILLS: ROLE-SPECIFIC

*“For Software Engineers, we evaluate candidates on their ability to solve problems with code and algorithms and their demonstrated success building products or systems for people to use. We don’t focus on one specific programming language or platform.”*

*– Director of Engineering*

*“[S]pecific programming languages are required for some, but not all, roles.”*

*– CTO and Co-Founder*

*“Programming is about being a good learner of new tools, not mastery of any one.”*

*– CTO and Co-Founder*



---

**While foundational problem-solving skills are broadly applicable across in-demand tech jobs, each specific role demands a suite of constantly evolving tools, languages, and skills.** Within web development and software engineering, specific roles such as front-end engineer or back-end engineer may require specific technical skills, whereas full-stack developers require proficiency across each of these layers.

The following observations are based on feedback regarding the skills, tools, and languages that employers most often look for in today’s market, but these will likely change in the years to come. Also included below are general observations from industry professionals about the core skills needed to adapt to the changing landscape within these specific fields.

### Back-End

#### Employer Voices: Back-End Requirements

*“[For the back end] I firmly believe any language + quick learning is all you need, but it is very true that many companies want you to come in with experience on their stack. Every company uses a different stack though, so you have to research ahead of time and practice with that stack before the interview. Learn common stacks... to widen your selection.”* – NYC Software Engineer

- **Knowledge of one language + framework; ability to quickly learn more:** There is no one language (or set of languages) that ALL tech employers require for back-end development. While some backend languages may be more widely used than others, some companies use a “stack,” or combination of languages and frameworks, that may include products written in several different languages, and a few companies even have proprietary derivations of languages that individuals must learn on the job.

Employers agree that it’s important to be proficient in at least one language and to be able to use that tool to write code that is readable and does what it’s intended to do. Additionally, candidates need to be able to leverage their knowledge base to learn whatever languages their employer requires. Therefore, demonstrating one’s ability to pick up additional languages quickly is a valuable asset for candidates seeking roles as web developers or software engineers.



- 
- **Understand the links between company size, sector, and languages:** There are a few exceptions to the know and learn rule above – for instance, certain types of firms, including those that run on large enterprise systems often found in the financial services sector or large scale publishing/media platforms, are likely to prefer that candidates have specific proficiency in Java. Even different types of finance-oriented roles have different language requirements. Individuals who are interested in working in high frequency trading, for example, may find employers looking for specific knowledge of C++.

Similarly, some companies, including smaller startups, may expect a candidate to come in with existing knowledge of the languages in their stack so that they can contribute immediately.

Generally speaking, it's important for candidates – and the educators and training providers preparing them – to determine what sector(s) and what kind of companies they ultimately hope to work in and determine what languages may be more prevalent in their targeted fields. Understanding what stack a company uses, and when possible practicing using that stack prior to an interview, is essential.

Some options for popular back-end languages + frameworks include:

- o Java + any number of frameworks (e.g. Spring, Play)
- o C# + .NET
- o Javascript + Node (with Express)
- o Python + Django (or Flask)
- o PHP + any number of frameworks (e.g. Laravel)
- o Ruby + Ruby on Rails
- o Nice to have: Other languages that are back end with a framework: Go, Scala, etc.

## Front-End

### Employer Voices: Front-End Requirements

*“Should a student learn [specific front-end frameworks]? The answer is yes, [one] being the super-sexy one currently, but fundamentally the idea is that getting exposure to a front end framework on TOP of the vanilla APIs that the browser provides is a valuable and sought after skill from employers.” – NYC Software Engineer*

- 
- **Learn the core languages:** Aspiring full-stack and front-end web development professionals should have a firm grasp of HTML, CSS, and JavaScript. The use of these languages has remained fairly constant over time and is often cited by employers.
  - **Choose and learn a front-end framework; keep an eye on trends and update skills:** In addition to mastering core languages, employers value and look for candidates who can use front-end frameworks. That said, front-end technologies, including front-end frameworks, change rapidly; what's popular one year can be obsolete the next. Because of this, it's important for aspiring tech professionals to stay connected to the developer community to understand what frameworks (and other tools) are currently in use, track and adapt to changes in the use of these tools over time, and embrace a constant learning approach that enables them to learn new tools and approaches as needed. Aspiring tech professionals can connect to the developer community by going to front-end meetups and staying in touch with the people they meet there, including by following them on Twitter.

## Databases

According to employers, many tech professionals who work in full-stack web development need to understand how data is stored and retrieved. An understanding of the differences between **SQL (relational databases)** and **NoSQL (non-relational databases)** databases is valuable. Though different businesses require knowledge of different approaches, many employers have expressed an interest in candidates that have some understanding of PostgreSQL or MySQL languages for communicating with relational databases.

## Working with different layers of the tech stack

While employers hire engineers who specialize in front-end, back-end, and data specifically, they increasingly cite a need for developers who understand how to communicate across the layers of the stack to complete their work. For example, even though knowledge of Python and Java aren't generally considered to be required skills for front-end developers, individuals in these roles may need to (1) make changes to an API that has been written in Python or (2) understand how to “talk” to a Java backend to get it to communicate with the front-end.

## Common Theoretical Underpinnings

Some, but not all, employers require candidates to have a strong understanding of common theoretical underpinnings of software development, including data structures, algorithms, and architecture.

---

When interviewing candidates, employers often look for those who can identify which data structures or algorithms they may wish to utilize given the particular task at hand and articulate the tradeoffs of using one over another in different instances.

Common requirements include:

- **Data structures:** Understanding the various use cases as well as the trade-offs for commonly used types of data structures:
  - o Array / Linked List
  - o HashMap / Set
  - o Tree / Graph
  - o Stack / Queue
- **Algorithms:** Understanding the runtime complexity of an algorithm and being able to articulate the trade-offs between runtime and memory complexity for commonly used algorithm categories:
  - o Data
  - o Pathfinding
  - o Searching
  - o Sorting
- **Architecture:** An understanding of how to structure larger projects, and an ability to articulate this approach in interviews.

Specifically, candidates should understand and be able to explain:

- o **The various systems that make up an application's technical ecosystem and how they interact with one another** to accomplish the goals of the application. (For example: how a data aggregation system may interact with an API server, which may then interact with a front-end web application.)
- o **The various components that comprise a large technical system.** (For example, being able to articulate what pieces make up a large technical system that aggregates and standardizes data from multiple external sources.)
- o **How a large technical system scales** along with client demand and need. (For example, being able to answer the question: How does a backend that handles x users today grow to handle 10x users in the future?)

---

### 3. TECHNICAL SKILLS: APPLIED

*"[We] need been there, done that, pushed code."*  
– Tech Professional, NYC Tech Company

*"The beginning of everything in software engineering is version control. If your [students] know how to use Git we can work with them. If they don't they are at a significant disadvantage compared to other schools."* – Intern Supervisor, NYC Tech Company

*"Wherever you are, you're going to use Git and this is used everywhere."* – Intern Supervisor, NYC Tech Company

Employers consistently cite a need for candidates who can demonstrate applied technical skills, ideally developed in an industry setting. This includes:

- **Experience building a production-worthy application:** Given resource constraints and limited time of current employees, many employers need candidates who have already built things and pushed code at scale, and who therefore can hit the ground running. This includes knowing how to design good modular code that is testable and scalable.
- **Building a product as part of a team:** Many people picture a typical tech professional as a solitary figure working by herself in front of the computer, cut off from any human contact. While all tech professionals must be able to work independently and use their own judgement to resolve problems, modern tech workplaces rely heavily on collaboration – developers typically write code that will be combined with others' work to build one product – and good candidates must be able to excel in this environment. In particular, this includes an ability to:
  - o **Create a maintainable product:** writing code that others can easily read, understand, and update
  - o **Work from others' (maintainable) code:** being able to take a body of code that's been developed by others and iterate upon it
  - o **Engage in collaborative software development,** whether through **pair programming** (a practice in which two developers use one workstation to write code and simultaneously check for errors) or other approaches

- 
- o **Conduct code review:** reviewing another engineer's code to identify errors
  - o **Participate in continuous integration:** combining individual developers' code frequently, while the code is still being developed, in order to test the code as a whole and make adjustments as needed
  - o **Use collaborative tools,** such as Git, Slack, and Internet Relay Chat (IRC)
- **An understanding of and ability to use common industry tools, approaches, and resources:** In addition to specific skills, employers look for individuals who have experience with common industry tools and approaches required to build and ship products in a business environment. These include:

**Most common:** Most companies look for individuals who have experience with the following. In approximate order from most to least important:

- o **Version control, especially using GitHub:** Git and GitHub have become industry standard development tools. Git allows users to keep their code organized and track their progress over time. Being able to push to GitHub, a website that houses code and contribution history, is an important part of collaborative software development. Note that employers often expect for candidates to have contributed to GitHub via "real life" projects, not only through homework assignments.
- o **Common development methodologies** (e.g. Agile, including scrum and sprint meetings; waterfall)
- o **Libraries:** an understanding of and ability to navigate collections of code that are open for use by others
- o **Using the Terminal/command line** in order to get a computer to follow commands directly without relying on an intermediary (e.g. without using additional software)
- o **Continuous testing,** which can include load testing and unit testing
- o Others, including **automation** – e.g. writing scripts that automate repetitive tasks

---

**Nice to have:** The following can accelerate learning and make a candidate stand out but are generally not required from an entry-level candidate:

- o **Experience contributing to open-source projects,** including those posted by companies on GitHub
  - o **Experience with public APIs** (application program interfaces) including creating, accessing, integrating them into applications
- **An understanding of how an individual's work fits into the overall business structure and ability to recognize, prioritize, and work within real-world business constraints:** Beyond specific skills and approaches, employers look for individuals who understand the business context in which they're working; tech professionals need to *understand business needs, understand the real-world implications of their work, and make decisions based upon real-world business constraints.* The ideal solution in a theoretical environment that contains no limits on funding, staff, or other resources may look very different from the ideal solution for a company with limited resources. Specifically, employers look for individuals who understand:
    - o **Requirements gathering:** Understanding a company's reasons for doing a particular project and stakeholders' goals
    - o **Scaling:** Large companies typically need employees who have experience in bringing technologies to scale. This includes:
      - \* **Taking business requirements into account when considering trade-offs** involving choices amongst functionality (speed and efficiency), cost, and scale needed to build code for products of various sizes
      - \* **An ability to explain the reasons for making these tradeoffs** and to readjust if/as needed to better fulfill business needs
    - o **Understanding of roles in the software development lifecycle,** including how an individual's work contributes to the broader product team



#### 4. EXPERIENCE AND EXPOSURE

##### Employer Voices: Experience and Exposure

*“A few candidates seemed very timid in sharing the technical skills they gained in coursework/projects. Although young/new to workforce they should embrace and share those experiences.” – Product Manager, NYC Tech Company*

*“One reason we were so interested in [student] was the number and quality of her hackathon projects. She clearly has a commitment to social justice and she can code.” – Intern Supervisor, NYC Tech Company*

*“Any additional opportunities to expose students to how their classwork connects to the real world (e.g. hackathons, apprenticeships, etc.) I think could go a long way.” – Product Manager, NYC Tech Company*

**Experience is crucial.** Learning the technical basics is essential – but it’s not enough. Whether gained through an internship, classwork, participation in hackathons, all of the above, or other ways, individuals must gain experience building products in a real-life setting in order to be strong candidates for NYC’s select entry-level tech jobs.

***Many of the technical and professional skills that employers require for in-demand tech jobs – including the ones described here – are best and most easily developed through applied experience.***

Regardless of the size of a company, experience is often desired. Small startups, for instance, are often relatively time- and resource-strapped and typically need employees who can dive into their work without much additional training from founders or other engineers. While larger companies can usually dedicate more resources to onboarding and developing employees, some need individuals who have experience working with technologies at massive scale. They therefore value candidates with experience weighing the tradeoffs needed to build code for a product with 100,000 or 1,000,000 users rather than a smaller user base.

There are many ways to gain experience. The most straightforward way to gain experience (particularly on large-scale products) is through an internship or similar opportunity at a tech company, but landing an internship also requires emerging talent to demonstrate passion and commitment through other types of experience. To that

---

end, there are many additional ways in which emerging talent might gain experience in building applications that demonstrate their aptitude.

**Aspiring (and all) tech professionals can gain experience through one or more of the following:**

- **Experience on the job** through an internship, apprenticeship, co-op, or other work-based opportunity
- **Personal/side projects**, including creating their own applications or other products and making them publicly available. This is an especially important way to *develop and share code that employers can see* (vs. code built for a company during an internship, which the company may not allow to be shared), which is critical for building a strong portfolio.
- **Participation in the NYC tech community**, including going to meetups, blogging, and following industry blogs, as a way to connect with other developers, stay abreast of new developments in the field, and hone skills
- **Committing code** to GitHub: Employers often review candidates' GitHub accounts to see what they've pushed and whether a candidate has shared a lot or a little amount of code
- **Contributions** to open-source software
- **Participation in hackathons** and similar activities
- **Additional project-based work** (through school, training bootcamps, etc.)

---

## 5. PROFESSIONAL SKILLS AND INTERESTS

### Employer Voices: Professional Skills and Interests

*"This industry changes constantly. There is a lot to pick up about being in tech to be effective, and there will always be new things around the corner. Being able to absorb information quickly will be invaluable." – Engineering Lead, NYC Tech Company*

While technical skills and experience are crucial to a candidate's success, they aren't enough; candidates often need to demonstrate passion for tech and a range of professional skills in order to land an entry-level tech job in New York City. These include:

- **Passion for tech:** Employers almost universally look for a candidate to demonstrate a passion for tech. Candidates can demonstrate this in a number of ways, especially through gaining work experience, personal/side projects, and the other types of experience described below. Many employers also expect candidates to keep up with, and be able to talk about, the latest tech news.
- **Ability to work independently; eagerness and ability to work collaboratively:** While employers cite the ability to work independently as important, many tend to place more emphasis on the need to work collaboratively as something that many candidates are currently missing. While all tech professionals must be able to work independently, modern tech workplaces rely heavily on teamwork, and strong candidates must be able to work collaboratively with both technical and non-technical colleagues (see building a product as part of a team, above, for more details).
- **Communication:** Time and again, employers emphasize the importance of being able to communicate – with team members, supervisors, in interviews, with clients – both verbally and in writing. Again, contrary to one popular image, a tech professional doesn't work in isolation in front of a computer all day long; they must be able to clearly and effectively communicate with others to accomplish their work. As one TTP program manager puts it, "even with epic coding talents, you will not land (or succeed in) a job if you cannot speak clearly about the relevant aspects of your successful projects." This includes:
  - o **Getting people excited about your ideas** in order to move your work forward

- 
- o **Anticipating objections and listening to feedback**
  - o **Speaking to audiences in various roles**, both technical and non-technical, including:
    - \* **“Translating” tech into human**: Communicating complex ideas simply
    - \* **Tailoring communications for different audiences** (e.g. communicating differently with an executive than with a fellow programmer)
  - o **Conveying progress and roadblocks to your team** in order to advance your project
  - o **Proactively, effectively communicating issues**, including raising questions and ideas
  - o **Using correct grammar** in order to be easily and accurately understood by teammates, clients, and others in the organization
  - o **Technical communication** is a particularly important part of this; candidates must be able to effectively explain their code, describe how and why they made particular coding decisions, and what they’d do if faced with different options. Candidates are often expected to demonstrate these skills in particular during the technical interview process.
  - Employers also look for:
    - o **A proactive approach**, which is especially important for start-ups and other environments that depend on each individual contributor to bring their own best ideas to the table and drive work forward without needing constant direction or supervision,
    - o **An ability to juggle multiple tasks at once**, as well as **time management and task completion skills**, which are important in settings in which individuals may need to work on several projects or different aspects of a project simultaneously, and
    - o **Attention to detail**, which is crucial for jobs in which one missing comma or one misplaced bracket can mean the difference between a working or non-working product.
- 

- 
- **Job application and interview-related skills**: In addition to developing the technical and professional skills they need to succeed on the job, candidates must be able to effectively demonstrate these qualifications, particularly in an interview setting. In particular, employers look for:
    - o **A clear resume and strong online presence** that clearly communicate candidates’ qualifications, skills, projects, and experiences specific to the job for which they’re applying
    - o **An online portfolio** that gives employers an opportunity to review applied work a candidate has done in the past (particularly if the candidate does not have a long work history)
    - o **An effective, easily adaptable elevator pitch** that clearly communicates who the candidate is, their specific career goals (e.g. what type of company they want to work at, in what type of position, and why), and why they’re qualified for a specific opportunity. Individuals should be able to refine their elevator pitch as needed to most effectively pitch themselves for opportunities at companies of different sizes (larger companies may need very specific contributors; smaller companies generally need individuals who can wear multiple hats)
    - o **Clear understanding of the company** where they’re interviewing and where they picture themselves in the company – e.g. on a particular role and/or team
    - o **General interview skills and etiquette**, including the ability to explain the work they’ve done on past projects or specific work within experiences; how to conduct themselves in an interview (including eye contact, handshakes, body language, etc.); and follow-up (e.g. asking for a business card; sending a thank-you note, etc.)
    - o **Excellent performance in a technical interview**, including the ability to demonstrate technical proficiency through a number of collaborative techniques. Different employers have different approaches and expectations. Some common approaches include:
      - \* **Whiteboarding**: Solving a coding challenge in real-time while explaining the approach out loud to a group of interviewers. Through
-

---

this process, candidates have an opportunity to demonstrate not only their technical proficiency but equally importantly how they approach problems, respond to feedback, overcome obstacles, and propose alternate solutions.

- \* **Take-home coding assignments:** Writing assigned code before arriving at an interview. Once in the interview setting, a candidate may be expected to walk employers through their solution and answer follow-up questions.
- \* **Pair programming:** As described above, an opportunity to partner with an experienced programmer or hiring manager to write code together.
- \* **Collaborative debugging:** Working with others to find and fix bugs in a body of code.



---

## NEXT STEPS FOR DELIVERING QUALITY TALENT

The value of more accurately defining what makes a strong candidate for in-demand tech roles cannot be overstated. Not only is it essential to closing the city's current skills gap, it also will help to surface qualified talent reflective of all the creativity and diversity that five boroughs have to offer.

In order to expand the delivery of quality jobs for New Yorkers and quality talent for the city's businesses, TTP has engaged employers in more precisely defining the core competencies, skills, and tools that today's in-demand tech workforce requires. Through programs like the NYC Web Development Fellowship, delivered in partnership with the Flatiron School, TTP already has demonstrated that New Yorkers equipped with industry-informed skills can go on to thrive at companies like Microsoft and Goldman Sachs, regardless of whether or not they hold an undergraduate degree.

Continuing to articulate and share industry feedback on the skills needed to secure and succeed in tech roles, the NYC Tech Talent Pipeline looks forward to continuing to work together with its partners to ensure New York is expanding opportunities for a 21st century workforce.

---

## ACKNOWLEDGEMENTS

The NYC Tech Talent Pipeline gratefully acknowledges the contributions of the many industry partners and advisors who made the creation of this resource possible, including the Tech Talent Pipeline Advisory Board:

**LinkedIn, Verizon, Union Square Ventures, Alley Corp, Goldman Sachs, Facebook, Etsy, Kickstarter, Infor, Google NY, AT&T New York, ZocDoc, Livestream, Stack Exchange, MongoDB, CTO Club, Microsoft NY, BoxGroup, JP Morgan, AppNexus, Hopscotch, Viacom, Interbrand NY, Newscorp, FourSquare, and Spotify.**

We would also like to sincerely thank the following individuals for their additional insight, partnership, resources, and brainpower:

**Maryam Ali, Max Sklar, Derek Brown, Marco de Masi, Ori Schnaps, Ben Sussman, Jon Chan, Leigh Shapiro, Karl Laraque, and Jessica Hills.**

## ENDNOTES

<sup>i</sup>HR&A Advisors, Inc., The New York City Tech Ecosystem: Generating Economic Opportunities for All New Yorkers, March 2014, [http://www.hraadvisors.com/wp-content/uploads/2014/03/NYC\\_Tech\\_Ecosystem\\_032614\\_WEB.pdf](http://www.hraadvisors.com/wp-content/uploads/2014/03/NYC_Tech_Ecosystem_032614_WEB.pdf)

<sup>ii</sup>Ibid.

<sup>iii</sup>Ibid.

<sup>iv</sup>LinkedIn Economic Graph Research: New York, February 2015, <http://www.slideshare.net/linkedin/economic-graph-research-new-york-city>

<sup>v</sup>Ibid.

<sup>vi</sup>New York State Department of Labor, Long-Term Occupational Employment Projections, 2012-2022, <https://www.labor.ny.gov/stats/2012-2022-NYS-Long-Term-Occupational-Projections.xls>

<sup>vii</sup>Duckworth, A. T., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: Perseverance and Passion for Long-Term Goals. *Journal of Personality and Social Psychology*, 92(6), 1087-1101. <https://www.sas.upenn.edu/~duckwort/images/Grit%20JPSP.pdf>





